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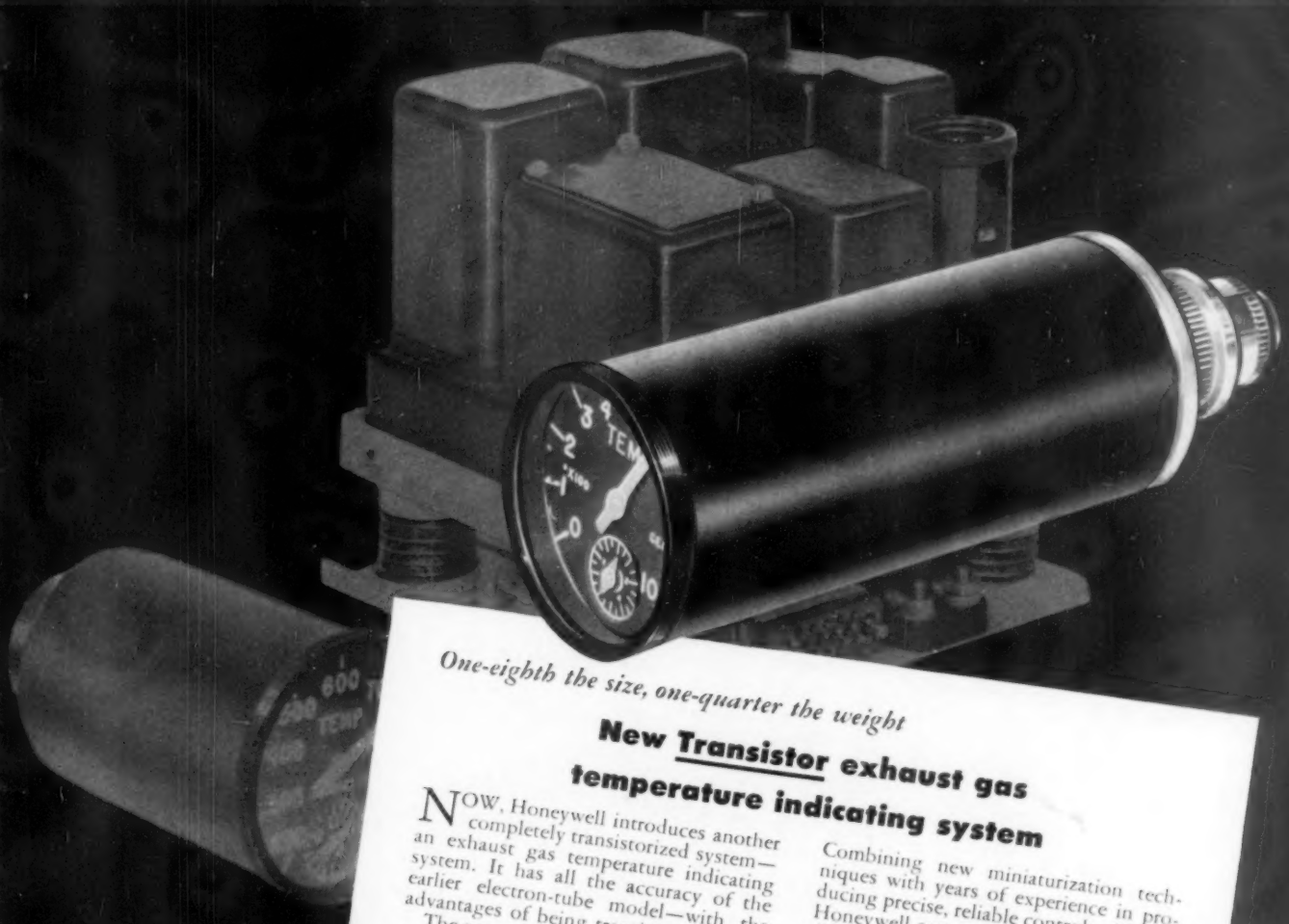

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New jet joins trend to Tubeless

THE NAVY'S newest jet fighter, Chance Vought XF8U-1, flies at supersonic speeds in level flight and is designed for carrier operation. To withstand the punishment of high-speed take-offs and landings on carrier flight decks, it is equipped with B.F.Goodrich Tubeless Tires.

The tires were chosen as original equipment on nose and main landing wheels. This makes the XF8U-1 one of the latest additions to a growing roster of military and commercial planes now making safer landings on B.F.Goodrich Tubeless Tires.

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SEPTEMBER 19, 1955

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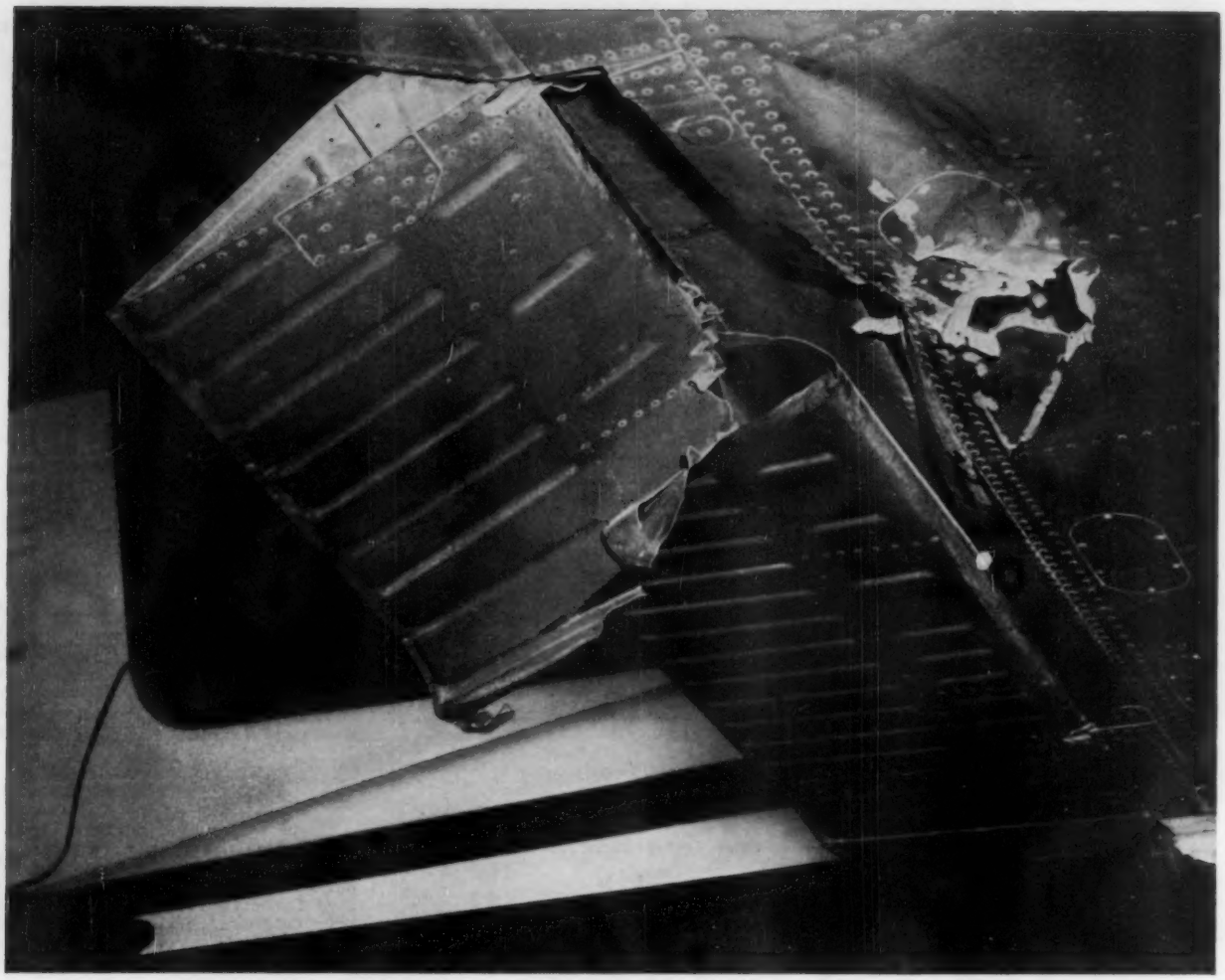

The Plus Factor

The above photograph shows the area of damage in the right wing of a BEECHCRAFT Twin-Bonanza, caused by a mid-air collision.

The Twin-Bonanza, with six people aboard, was struck by the top of the tail of a military jet airplane which inadvertently was brought too close by its pilot while making a night inspection. The jet airplane came past from behind the BEECHCRAFT and knocked this hole in the flap and trailing edge of the wing. The top of the jet's tail was knocked off and was left inside the wing.

The BEECHCRAFT retained its usual good flight characteristics and was landed without further incident.

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NEWS DIGEST

Domestic

Research Laboratories of Colorado Inc. have completed the world's first commercial processing plant for rare earths at Newton, Ohio. The new plant will offer 14 rare earths with wide applications in alloying steel and aluminum for aircraft manufacturing applications.

Nuclear bomb casings are undergoing aerodynamics tests at Atomic Energy Commission desert base on edge of Salton Sea, Calif. Casings with dummy warheads are dropped on the range and tracked with elaborate electronics systems to determine their characteristics. Test items are also equipped for telemetering. Sandia handles work at the $5 million facility.

Aluminum extrusion plant at Halethorpe, Md., has been purchased for $3,841,000 cash by Kaiser Aluminum & Chemical Corp. from General Services Administration. Plant has been under lease to Kaiser since 1951. It contains five extrusion presses of 4,400, 1,600, 500 and 2,500-ton capacity. Company now intends to nearly double its aluminum extrusion capacity to 46.2 million pounds annually with installation of four new presses of 2,750 and 3,250-ton capacity.

External wing tanks are being installed on Boeing B-47s by Lockheed Aircraft Corp.'s Marietta, Ga., facility under an Oklahoma City Air Materiel Area contract. Firm says the tanks are installed in hours and the planes flown away immediately.

Prototype Frye F. 1 transport, designed as a DC-3 replacement for feederline and small, rough-field operation is scheduled to make its first flight next year. Powered by four 600-hp. P&W Wasps, the high-wing F. 1 will gross 30,000 lb., carry 50-60 passengers at a top speed of approximately 170-mph. with an operating cost of about 1.3 cents per seat-mile. A new firm headed by Jack Frye, former chief executive of Trans World Airlines and General Aniline & Film Corp., will handle plane's design. Production in the U.S. will be contracted to a firm with aircraft manufacturing facilities. F. 1 price is planned at $350,000. Frye told AVIATION WEEK he expects initial orders to be placed by a Far East airline. Frye Corp. address: 617 Texas St., Ft. Worth.

James R. Ray, 63, aviation consultant, artist and author, died last week in New York City. He made his first solo flight in 1911.

Douglas Skyhawk Shows Revised Tail Cone

Jet exhaust shield has been added on upper rear of Douglas A4D-1 Skyhawk's fuselage to prevent blast of Wright J65 from disrupting airflow past the plane's tail surfaces. The modification was one of the new features visible on the Skyhawk during its display on the ground during the recent National Aircraft Show, Philadelphia. Vortex generators were also seen on the leading edge near the wingtips and on the fuselage and wing roots near the trailing edges. Skyhawk also has its long carrier deck arresting hook extended, the unit hinged well forward under the fuselage.

Swissair has ordered eight Convair 440 Metropolitan transports, bringing orders for this quieter, faster version of the Convair 340 to 46. Additional orders will be announced soon.

Mackay trophy for 1954 has been awarded Strategic Air Command's 308th Bomb Wing, Hunter AFB, Ga., for round-trip nonstop 10,000-mi. flight to Europe from Hunter last year by two of the unit's Boeing B-47s. Planes were refueled aloft four times, twice in darkness.

Financial

Ryan Aeronautical Co., San Diego, Calif., reports net earnings of $1,107,977 for the first nine months of 1955 on income of $29,105,917. Comparable period last year showed net income of $1,628,125 and sales of $34,199,976. Ryan's backlog as of July 31: approximately $38 million. Firm's recent electronics contracts includes $5 million BuAer award for an automatic navigation system (AW Sept. 2, p. 18) and $2.5 million USAF contract for the further advanced development and testing of various supersonic missile guidance systems.

North American Aviation, Inc., has voted extra dividend of $1 per share in addition to regular quarterly 75 cents dividend payable Oct. 6 to holders of Sept. 20.

General Controls Co., Glendale, Calif., has declared dividends of 20 cents on common stock and 37.5 cents per share of preferred shares, payable Sept. 30 to holders of record Sept. 15.

International

The Bristol Aeroplane Co. announced plans to form three new subsidiary companies to keep pace with "the progressive growth" of the company's aviation activities at home and overseas.

They are: Bristol Aircraft, to be devoted to the research and production of airframes, helicopters and missiles; Bristol Aero Engines, and Bristol Cars. The diversification move was announced shortly after Peter Masefield, chief executive of British European Airways since October, 1949, resigned that post to become Bristol's managing director.

Most of the 61 German aviation designers and scientists working in Argentina have not renewed their contracts with that country's government and industry and plan to return to their homeland, according to Flugwelt, German aviation magazine.

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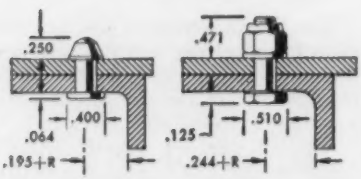

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AVIATION CALENDAR

Sept. 21—Southwest Airmotive Engine Forum, sponsored by Pratt & Whitney and Bendix, Melrose Hotel, Dallas.

Sept. 21-22—American Helicopter Society, second West Coast Forum, Hollywood-Roosevelt Hotel, Hollywood, Calif.

Sept. 28-29—American Institute of Electrical Engineers and Institute of Radio Engineers, Park Sheraton Hotel, Detroit.

Sept. 29-30—Radio Technical Commission for Aeronautics, fall assembly, Hotel Statler, Washington, D. C.

Oct. 3-5—Eleventh National Electronics Conference, Hotel Sherman, Chicago.

Oct. 4-6—Eleventh annual Aircraft Spark Plug and Ignition Conference, sponsored by Champion Spark Plug Co., Secor Hotel, Toledo, Ohio.

Oct. 5-7—National Business Aircraft Assn., eighth annual Meeting and Forum, Sheraton-Cadillac Hotel, Detroit.

Oct. 5-7—1955 National Airport Conference, sponsored by American Association of Airport Executives and University of Oklahoma, Norman, Okla.

Oct. 5-9—World Plastics Fair & Exposition, National Guard Armory, Los Angeles.

Oct. 7—Escape from High Performance Aircraft Symposium, sponsored by Institute of Transportation & Traffic Engineering Ext. at U.C.L.A., Aeronautical-Engineering Assn., Institute of the Aeronautical Sciences, IAS Building, Los Angeles.

Oct. 11-14—National Association of State Aviation Officials, annual convention, Dallas.

Oct. 11-15—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, Hotel Statler, Los Angeles.

Oct. 18-19—Seventh annual Aerial Dusting and Spraying Conference, sponsored by the Washington State Aeronautics Commission and the State College of Washington, Wenatchee, Wash.

Oct. 17-21—National Safety Council, 43rd National Congress and Exposition, La Salle and Conrad Hilton Hotels, Chicago.

Oct. 17-21—International Air Transport Assn., 11th annual general meeting, Waldorf-Astoria Hotel, New York.

Oct. 20-21—Sixth annual National Noise Abatement Symposium, Armour Research Foundation, Chicago.

Oct. 24-25—Institute of Radio Engineers' Professional Group on Electronic Devices, first annual Technical Meeting, Shoreham Hotel, Washington, D. C.

Oct. 25-27—Technical Conference on Aircraft Electrical Applications, sponsored by American Institute of Electrical Engineers, Hollywood-Roosevelt Hotel, Los Angeles.

Oct. 26-28—Southwestern Airport Managers' Assn., annual meeting, Greenville, S. C.

Oct. 30—Second annual Topeka Aviation Day.

Oct. 31-Nov. 1—Institute of Radio Engineers, 1955 East Coast Conference on Aeronautical and Navigational Electronics, Lord Baltimore Hotel, Baltimore.

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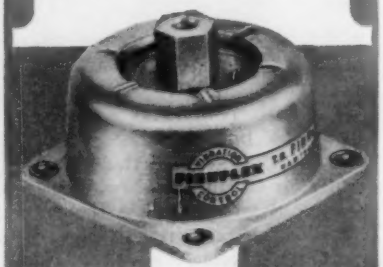

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Perry R. Roehm, executive vice president, Norden-Ketay Corp.

George E. McMahon, executive vice president, Vulcan Containers Inc., Bellwood, Ill.

Douglas L. Cochran, vice president-sales, Resin Industries, Inc., Santa Barbara, Calif.

W. H. Niles, vice president-sales, East Coast Aeronautics, Inc., subsidiary of Barium Steel Corp.

Irving Koss, vice president, Communications and Electronics Div. of Motorola Inc., Chicago. Other appointments: **Robert Barton,** asst. manager for Contract Technical Administration; **Paul Jones,** asst. manager for Contract Business Administration.

Dr. Charles L. Dunham, director, Division of Biology and Medicine of the Atomic Energy Commission; **Dr. Charles W. Shilling,** deputy director.

Honors and Elections

R. P. Hartley, secretary and chief accountant for Central African Airways Corp., elected vice chairman of International Air Transport Association's Financial Committee; **McOran Campbell** re-elected to the Technical Committee.

John M. Tyler of Pratt & Whitney Aircraft Div. and **Edward G. Perry, Jr.,** of United Aircraft Corp. will be awarded the Society of Automotive Engineers' Manly Memorial Medal for 1954 at SAE Golden Anniversary Aeronautic Meeting, Oct. 13.

Changes

D. S. Brady, secretary-treasurer of Consolidated Diesel Electric Corp., Stamford, Conn. Also promoted: **Herbert Gladstone,** comptroller; **Robert Smith,** personnel director.

Jack H. Parnell, treasurer and business manager of the J. B. Rea Co., Inc., Santa Monica, Calif.

Kennett W. Patrick, director of Transducer Division of Consolidated Engineering Corp., Pasadena, Calif.

Everett B. Garretson, director of engineering, General Devices, Inc., Princeton, N. J.

Roy C. Heacock, director of engineering, of Axelson Manufacturing Co., Div. of U. S. Industries, Inc., Los Angeles.

Leonard Smiley, manager of technical coordination of the Atomic Energy Div. of Sylvania Electric Products Inc.

Earl Washburn, manager of Electronic Systems Div. of Cook Electric Co., Chicago.

Thomas R. Darmody, assistant general manager of Vitro Engineering Div., New York.

K. O. William Sandberg, manager of the General Electric Plastics Dept., Decatur, Ill. **Glen P. Bieging,** manager of marketing research and product planning for General Electric Heavy Military Electronic Equipment Dept., Syracuse, N. Y.

(Continued on page 132)

INDUSTRY OBSERVER

► Two West Coast avionics firms believe it may be possible to use computers instead of engineers to design simple basic electronic circuits and currently are investigating its feasibility. Object is to speed the development of new equipment and ease the load on engineering. Development of avionic equipment requires considerable routine work which a special computer could perform far more rapidly.

► **B-47 crews from the 15th Air Force have been using their airborne radar for uranium hunting. At low altitude, radioactive ore shows up on radar. One Stratojet crew already has incorporated and filed claims on the basis of its aerial discoveries.**

► Several transistor manufacturers are experimenting with novel multi-stage units, consisting of two or more semiconductor crystals suitably interconnected and housed within the same small container which now houses only a single transistor. Principal problem involved is that of maintaining quality and characteristics of the several transistor crystals (see p. 95).

► **F-102 nose section will be used on the high-speed track at Edwards AFB, Calif., for ejection system tests.**

► North American Aviation F-107A will have a variable air inlet duct in order to improve thrust.

► **Arma's A-3 radar directed tail turret system for the B-52 reportedly has received the production nod over a competing system developed by General Electric's Aeronautics and Ordnance Systems Division. Ironic note is that the Arma system's superior performance stems from its novel radar, a new type developed and furnished by GE's light military electronic equipment department at Utica, N. Y., but not used in the competing GE tail turret system.**

► Bellanca Cruisemaster with retractable hydro-lift landing gear is expected to be demonstrated to military observers at Georgetown, Del., this month.

► **Boeing's KC-135, four-jet tanker, will have a starter on only one engine. Other three powerplants will be started with air bled from the first engine, saving considerable weight and space.**

► First row of stators in General Electric's big J79 turbojet engine are moveable. Engine fuel services as hydraulic fluid to position them.

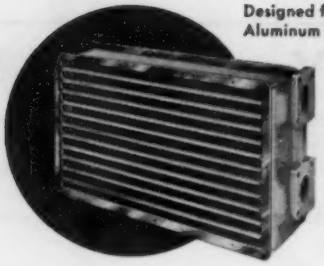
► **McDonnell Aircraft's new F4H jet fighter will have a system to pump up the nose gear pneumatically to give plane high angle of attack needed for catapult take offs. During normal takeoffs and landings, nose gear will be at normal extension.**

► New improved version of the Avro CF-100 all-weather jet fighter has been test flown and will be put into service by the Royal Canadian Air Force. The CF-100-4C has a speed of more than 600 mph. at an operational ceiling of about 55,000 ft.

► **USAF accelerated its test program of two twin-engine Convair YC-131C aircraft, equipped with Allison YT-56 turboprop engines, with a rapid turnaround operation that utilized each aircraft for 23 hr. and 10 min. in a 24-hr. period. Both aircraft have more than 1,000 hours of service. The flight evaluation program is aimed at 3,000 hours service by Jan. 31, 1956.**

► Bell Aircraft plans to make the transition from vertical to horizontal flight with its XV-3 convertiplane sometime this month. Aircraft recently made its vertical flight at Ft. Worth, Tex. (AW Aug. 29, p. 12).

► **Radio Receptors, Inc., Brooklyn, N. Y., will deliver this spring a new control console for Air Force tower operators which was designed by Air Research and Development Command. The new unit enables operators to keep posted on weather information, log flight plans, control runway lighting, maintain radio contact with planes and the radar approach control station. Radio Receptors also is building modification kits for towers where the new console will not be immediately available.**



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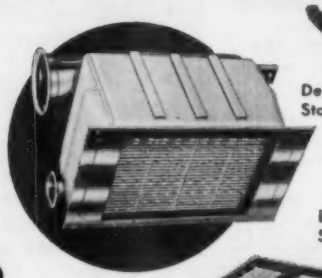
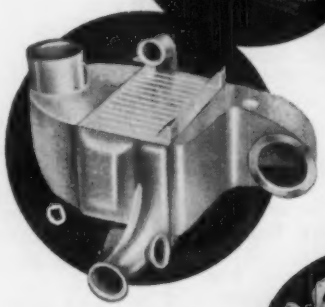


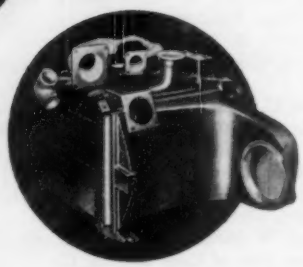
Designed for North American—
Stainless steel tube bundle

Designed for Stratos—
Stainless steel tube bundle

Designed for
Hamilton Standard—
Stainless steel tube bundle



Designed for Stratos—
Stainless steel tube bundle



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Washington Roundup

Design Reaction

USAF's decision to eliminate design competitions for new weapons systems (AW Aug. 8, p. 12) continues to bring mixed reaction from industry representatives in Washington. Generally, aircraft manufacturers with a wide variety of projects tend to favor the revision, calculating that they should get their fair share of Phase I contracts and save from one to two years of toil over paper for each design study they can escape. Nine aircraft manufacturers submitted design studies in the recent long range interceptor competition. Expert opinion is they spent $1.8 million collectively on the project. One company says it has spent as much as $750,000 on recent "paper projects," in sharp contrast to the $500,000 it cost to produce an experimental aircraft 10 years ago. Major complaint against abolition of design studies comes from small firms. They fear they will be stifled, warn that the new system just won't work in the long run.

Airline Mergers

The Senate's antitrust subcommittee is making a study to determine whether exemptions from anti-trust laws should continue to be granted regulated industries, such as airline transportation. The subcommittee also wants to ascertain whether Civil Aeronautics Board and other regulatory agencies apply the same standards in considering mergers used by the Department of Justice and Federal Trade Commission on mergers in non-regulated fields. Headed by Sen. Harley Kilgore (D.-W. V.), the subcommittee includes Sen. Estes Kefauver (D.-Tenn.), Sen. Thomas Hennings (D.-Mo.), Sen. Joseph O'Mahoney (D.-Wyo.), Sen. William Langer (R.-N.Da.), Sen. Everett Dirksen (R.-Ill.), and Sen. Alexander Wiley (R.-Wis.).

"Offset" Opposition

Post Office Department has repeated its opposition to legislation invalidating the "offset" principle, under which the excess earnings of an airline on one segment is used to offset subsidy requirements of another segment. In a letter to Chairman Warren Magnuson (D.-Wash.) of Senate Commerce Committee, Postmaster General Arthur Summerfield pointed out that the legislation would substantially boost Post Office's costs for the years prior to 1954, when the department was required to pay subsidies as well as mail transportation costs to the airlines. Last year there were hearings, but no action on similar legislation. There is little likelihood of enactment in the coming session of Congress. The measure is pending before the Commerce Aviation Subcommittee.

Liquor Aloft

First major policy problem tackled by Air Transport Assn. new president Harold "Pete" Pearson is the question of liquor service by member airlines.

Pearson has proposed that the scheduled airlines establish a code of conduct for serving alcohol and then exercise self-enforcement. Airline management opinion has been solicited by Pearson, who also sent along a suggested "creed" or "20 commandments" that management would agree to abide by in governing themselves.

Such action was apparently prompted by recent criticisms of the practice of serving drinks on commercial airliners coupled with the fact Civil Aeronautics Board member Joseph P. Adams, as acting chairman queried Pearson on the approach to the situation, if any. Pearson then sent Adams' letter to all airline presidents.

Senate Disarmament Group

The new Senate foreign relations subcommittee on disarmament proposals can be counted on to stand firm against and unilateral disarmament by the U. S. Members of the subcommittee advocate a strong military position for the U. S. at negotiations.

It includes Democratic Sens. Hubert Humphrey (Minn.); John Sparkman (Ala.); Alben Barkley (Ky.); Harry Byrd (Va.); Stuart Symington (Mo.); John Pastore (R. I.). Republicans are Alexander Wiley (Wis.); Bourke Hickenlooper (Ia.); William Knowland (Calif.); Styles Bridges (N. H.); Leverett Saltonstall (Mass.); John Bricker (Ohio).

Rizley to Depart?

All indications point to Ross Rizley's departure from the Civil Aeronautics Board no later than the first of the year. Rizley made it no secret less than a year ago when he took the CAB chairmanship that it was an interim job until the Administration came up with a judgeship.

The outstanding job Rizley has accomplished in his short term at the Board might prove to his disadvantage in making a move to the courts. However, Rizley was promised the next opening and the GOP National Committee probably will make good prior to the 1956 elections.

Further shifting of the Board's membership poses a difficult problem for the Administration. Rizley made his appearance at a time when CAB was subject to vigorous criticism. He has been largely responsible for restoring a judicial atmosphere and breaking a log-jam of route and rate cases to give the Board a current workload status. Another scramble for a CAB membership like that preceeding Rizley's appointment could undermine the good work.

ARDC Headquarters

Air Force Secretary Donald A. Quarles is taking a new look at USAF's plan to locate the headquarters of Air Research and Development Command at Dayton, near the Air Materiel Command headquarters at Wright-Patterson AFB. Quarles wrote Sen. John Butler (R.-Md.), who, along with other Maryland delegates has bitterly opposed removal of the headquarters from Baltimore, that "I have directed that all design and planning phases of this proposed relocation of the ARDC that are specifically pointed toward Dayton be suspended."

There is unanimous agreement that ARDC needs a new permanent headquarters building. It is now sprawled in several buildings in Baltimore. USAF is—or was—firmly in favor of the Dayton location. A committee of the commanding generals of ARDC installations supported the move. The House Armed Services Committee voted $6 million authorization for a new building at Dayton. But the Senate Armed Services Committee had apprehensions over the centralization of USAF activities, and turned down the $6 million request noting that "a conclusive case has not been made for Wright-Patterson as the most advantageous location. —**Washington staff**

AVIATION WEEK VOL. 63, NO. 12
SEPTEMBER 19, 1955

AMC Warning: Perform or Lose Profit

Contractors' profit margin will depend on deliveries, outcome of service tests, Gen. Baker tells industry.

By Claude Witze

Dayton, Ohio—U. S. Air Force contractors will soon face profit penalties if they fail to meet performance specifications and delivery schedules.

A test contract with these provisions is being negotiated by the Air Material Command with a weapons system manufacturer.

The new policy was disclosed to aircraft industry representatives by Maj. Gen. David H. Baker, AMC Director of Procurement and Production, at a closed meeting on the West Coast. The Air Materiel Command last week revealed the new policy to AVIATION WEEK.

Gen. Baker said first steps toward enforcement of performance and delivery standards were taken within the past two years when AMC refused in some cases to allow full profit for contractors who had disappointed USAF as a customer.

AMC Watches Profits

Dayton, Ohio—Air Materiel Command, fully cognizant of the rising congressional interest in aircraft industry profits (see p. 16) is giving them generous attention.

Special efforts are being made to reward poor performance with bankruptcy if necessary, rather than with payment of dividends.

There will be no more profit made on bad products or on the procedure of modification to fix the faults of aeronautical lemons, if the blame must rest on the contractor.

"Whether or not the average overall profit allowances are out of line is a matter of opinion," according to Gen. Baker, "particularly in those many instances where a high percentage of profits are plowed back into facilities and development of the advancement of the aircraft industry and air power.

"However, in the profit area we are placing major emphasis on performance. We will continue to consider the risk assumed by the individual contractor, both as to types of contracts employed and to capital supplied.

"We feel," Gen. Baker said, "such steps will benefit the government as well as the industry as a whole for it will require more realistic planning and estimating from individual contractors."

No Performance Standard

In the past, meeting performance standards never has been a fixed provision of weapons system contracts. "In the future," AVIATION WEEK was told, "When a manufacturer says his airplane will be a Mach 3 weapon at 80,000 ft. his profit will depend on the outcome of our service test. We will tie his profit margin to his guarantee and penalize him if he fails to meet it."

It was made clear AMC also intends to wipe out the over-optimistic sales brochure as a menace to sound business.

So far there is no index or standard of measurement to determine how closely a new fighter, bomber, missile or major component—such as an engine—comes to specified performance. This problem AMC expects to solve in the near future through consultation with engineers from the Air Research & Development Command.

In his hard-hitting San Francisco speech, Gen. Baker outlined some major trends in USAF procurement policies.

Dollar Deliveries to Increase

Highlights from Gen. Baker's speech follow:

- **AMC is moving** toward greater competition in all procurement.
- **AMC will press** its efforts to buy at close firm prices.
- **AMC is determined** to relate price to the timely development of new products, encouraging maximum effort by contractors in the field of development.
- **AMC considers** the risk assumed by a contractor second only to performance in determining profit allowances.
- **AMC encourages** prime contractors to use subcontracting. In the future, there will be an estimate of the subcontracting structure before the contract is negotiated.
- **AMC will not permit** a contractor to have a competitive advantage through the use of government-furnished facilities.

Gen. Baker said that the level of USAF expenditures appears now to be steady, but that the nature of the hardware being purchased will continue to change.

"Our deliveries in 1953 were $5.6 billion," he said, "and in 1954 were $6.2 billion. In 1955 they probably will be $6.6 billion. Our estimate indicates slightly higher deliveries in 1956, 1957, 1958 and 1959."

However, Gen. Baker said, AMC found in studying its estimates for 1957 that continued purchase of the B-52 long range bomber and century-series fighters, accelerated a few months ago to meet the growing Soviet air threat, will tend to increase dollar deliveries.

"We find," he said, "that the increasing complexity of our weapons is increasing our costs to the point where our current estimates for 1957 are above the funds we feel may be available for

Maj. Gen. David H. Baker, 47, graduated from West Point in 1930 and since learning to fly in 1932 has served most of his military career in logistics and procurement assignments. During World War II, he was Deputy Commander of the 9th Air Force Service Command in England, and later was assigned as a member of the Joint Logistics Plans Group in the Office of the Joint Chiefs of Staff.

He attended the Harvard Graduate School of Business where he studied industrial management. He was comptroller of the Air Materiel Command before he became Director of Procurement and Production.

obligation. We do, however, forecast USAF materiel deliveries of about six or seven billion dollars a year for the next several years."

Missiles to Gain

Overall result of this situation, Gen. Baker says, will be a change in the type of goods to be purchased.

"First, the number of aircraft delivered is going down from its peak of last year. . . . For the Air Force to attempt to maintain each company in a stabilized situation is not practicable with increased competition in products and product development.

"However, in guided missiles production which . . . is primarily carried out by the present airframe industry, dollar deliveries will rise as dollar deliveries of airframes drop.

"It is also obvious from present trends that our dollar deliveries of electronics will increase substantially in the next few years. Engines, armament and other miscellaneous deliveries should remain fairly constant."

Realistic View

USAF's progress toward heavier competition, up heavily in the past two years, will increase more in the immediate future, Gen. Baker said. In this connection, he emphasized "impartial evaluations of our contractors products and their proposals."

He said AMC is able to take a more realistic view on price differentials as it insists on more utilization of the fixed price contract.

"Our newly announced policy to carry two companies on our major systems through Phase I development (AW Aug. 8, p. 12) will introduce a true competition in our major procurement areas," he said.

In addition to competition, Gen. Baker told the industry it faces more stringent price analysis and negotiation.

"We have found during the past year," he said "that we can achieve our goal of close prices if we have adequate cost information from the contractor and emphasize in our negotiations the factors of risk and performance.

"By adequate cost information we mean sufficient detailed data to convince us that the quoted price is fair and reasonable. In negotiations we will look carefully for indications that contractors are willing to accept normal business risk and fuller responsibility for products developed and produced.

"We will judge the reasonableness of a price by looking at past and anticipated performance in such areas as delivery, quality of product, control of cost, simplicity of design and maintainability."

In this connection, AVIATION WEEK was told, AMC is tending toward heavier reliance on incentive-type contracts. USAF wants to favor the manufacturer who comes up with improvements financed with his own capital.

Boeing's investment of $15 million in the prototype of the KC-135 tanker is cited as an example, "Carried out without much encouragement from us."

Gen. Baker said AMC is forced to watch "the relationship between price and the timely development of new products." He also joined forces to some degree with Trevor Gardner, Assistant USAF Secretary for Research and Development, by saying that AMC will encourage manufacturers to put a maximum effort into development.

He said, "This may mean expenditure of a greater proportion of each procurement dollar for product development and improvement. It will be our job to achieve this faster product development while still maintaining a reasonable relationship between the costs of development and the cost of delivered hardware."

While pressing primes to make maximum use of sub-contracting, Gen. Baker said, AMC will in the future make every effort "to utilize for major subcontracting activities those facilities in our basic aircraft industry which may become idle."

The AMC procurement chief said the stabilized procurement and production program will have an effect on mobilization plans, particularly when combined with the nature of nuclear warfare.

"Basically," he said, "our approach will result in the selection of our most critical weapons systems and creating through a somewhat higher level of inventory the capability to accelerate production over shorter periods of time in an emergency."

New Facilities Policy

Dayton, Ohio—USAF's Air Materiel Command is determined that the aircraft and related industries must provide more of their own facilities. Government-furnished tools and buildings are a thing of the past.

Furthermore, the companies that already have government buildings and hardware are not going to realize a competitive advantage. AMC policy is set against it.

Says Gen. David H. Baker, AMC Director of Procurement and Production:

"The willingness of contractors to provide and use their own facilities will be a major factor for consideration at the time of contract awards. This policy is designed to reduce USAF ownership of industrial facilities by placing greater responsibility upon industry for that factor of production—thus furthering our traditional concept of free enterprise."

Fuel Pipelines Save USAF Time, Money

Wright-Patterson AFB, Ohio—USAF's Air Materiel Command is saving $500,000 a year with the experimental installation of fuel pipelines into two Kansas bases.

Tests under way for two years at Smoky Hill AFB, and McConnell AFB use a system that supplements but does not replace conventional rail and truck shipments. In addition to the cash saving and the speed at which the pipelines move fuel, there are the following advantages:

- **A 75% cut in the number** of personnel needed to handle fuel at the bases.
- **A 75% cut in the time** required to receive fuel.
- **A 90% cut in the amount** of paper work.

AMC points out that in the event of enemy attack, they now have two alternative means of fuel transportation to rely upon in case one system is crippled. The pipelines are easy to repair in comparison with a rail or highway bridge knocked out by a bomb.

Plans are to set up multi-purpose fuel lines throughout the country, connecting tank farms where possible and running from the storage facilities to Air Force bases. The fuel lines are installed at the expense of the carriers and maintained by them until they enter government property.

De Havilland Develops Gyron Junior Engine

The de Havilland Engine Co., Ltd., has announced the development of a younger brother of the powerful Gyron Jet engine, the Gyron Junior.

The Gyron Junior, recently run for the first time, will be marketed as a high-powered engine for planes of smaller design than those using the original Gyron which has been type tested at 18,000 lb. thrust.

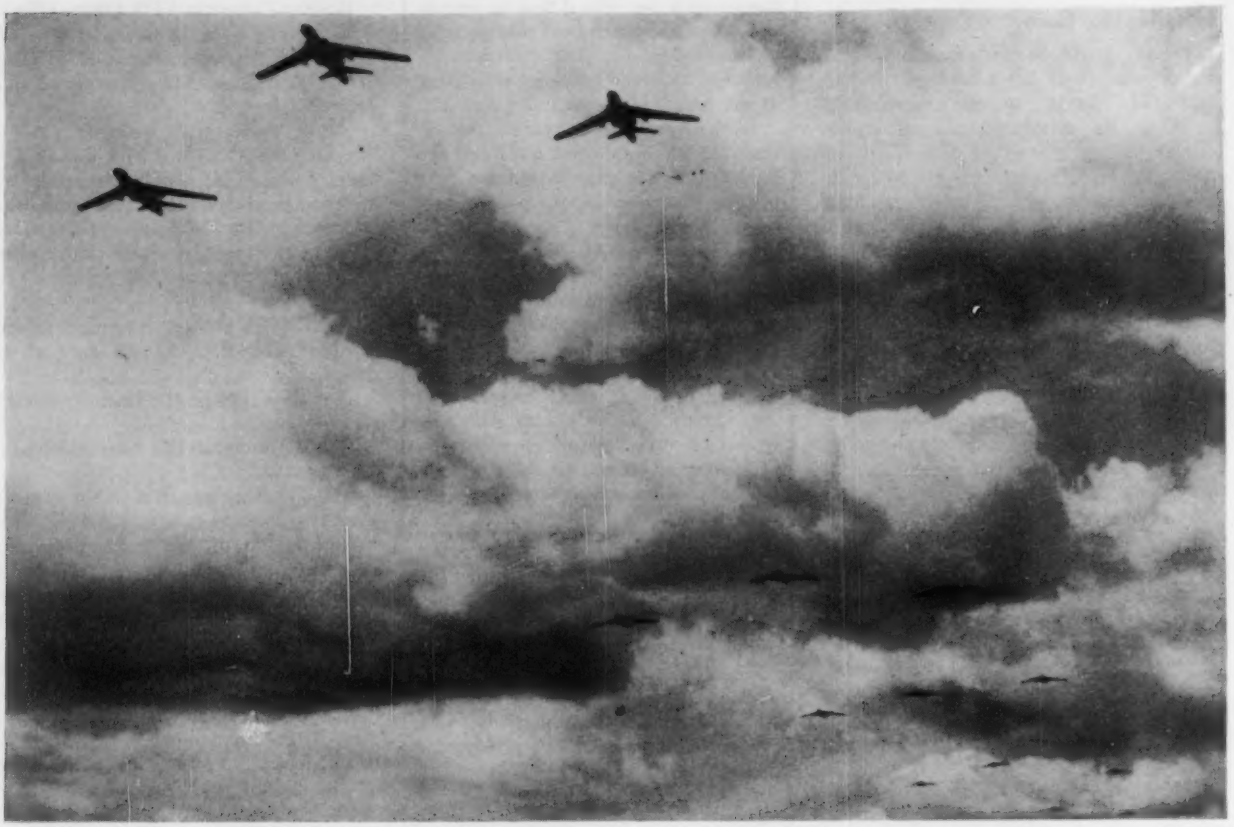
Although no technical details were revealed, a de Havilland statement said that the smaller engine has been "developed and run on the testbed in an exceptionally short space of time."

Navy Refuel Program

Five Navy fighter types now in production will be equipped with Flight Refueling's probe and drogue system.

Jet aircraft now being equipped include the Grumman F11F and F9F, Chance Vought F7U, McDonnell F2H, and the North American FJ, the Navy reported.

The Douglas F4D is not being equipped at the present time.



FORMATION OF 18 BADGERS roaring over Tushino is largest formation of new Red bombers ever photographed by foreign observers.

U.S. Suspends Titanium Sponge Program

The government's program to assist in the expansion of titanium sponge capacity was suspended last week by Office of Defense Mobilization.

Arthur S. Flemming, ODM director, said sponge production at present is considerably ahead of the indicated rate of military utilization of the metal. He added that sponge capacity under government contract now appears to provide for projected military use until 1957 but that the program will be under continuous study so that appropriate and timely action may be taken in the future if the situation changes.

Flemming noted that melting and fabricating problems appear to have temporarily delayed wider use of the metal. "Solution of these problems," he said, "is not too far distant and this industry should again move forward rapidly. Meanwhile, the government will continue to support research, development and pilot plant operations seeking improved or new sponge production measures."

The ODM action came after Flemming reviewed a report by his consultant, Harold S. Vance, a Studebaker-Packard executive, who has been studying the government's titanium program.

Here are three other recommendations from the Vance report which were accepted by Flemming:

• **General Services Administration** should include Brinnell Hardness specifications which will achieve higher quality and greater uniformity of titanium sponge in the event of future purchase contracts.

ANDB Tacan Symposium

Washington—The Air Navigation Development Board last week announced that its unclassified symposium on the technical and operational characteristics of Tacan will be held at the Hotel Statler November 3-4. Earlier plans had scheduled the symposium, which will be open to the public, for sometime in October.

• **Department of Defense** should make every effort to expand the use of titanium in military equipment on a production basis despite its present high cost. This is aimed at permitting rapid advances in fabrication technology and reducing costs.

• **General Services Administration** should hold purchases of sponge to a minimum consistent with the continuing development of a better product and with maintenance of production facilities.

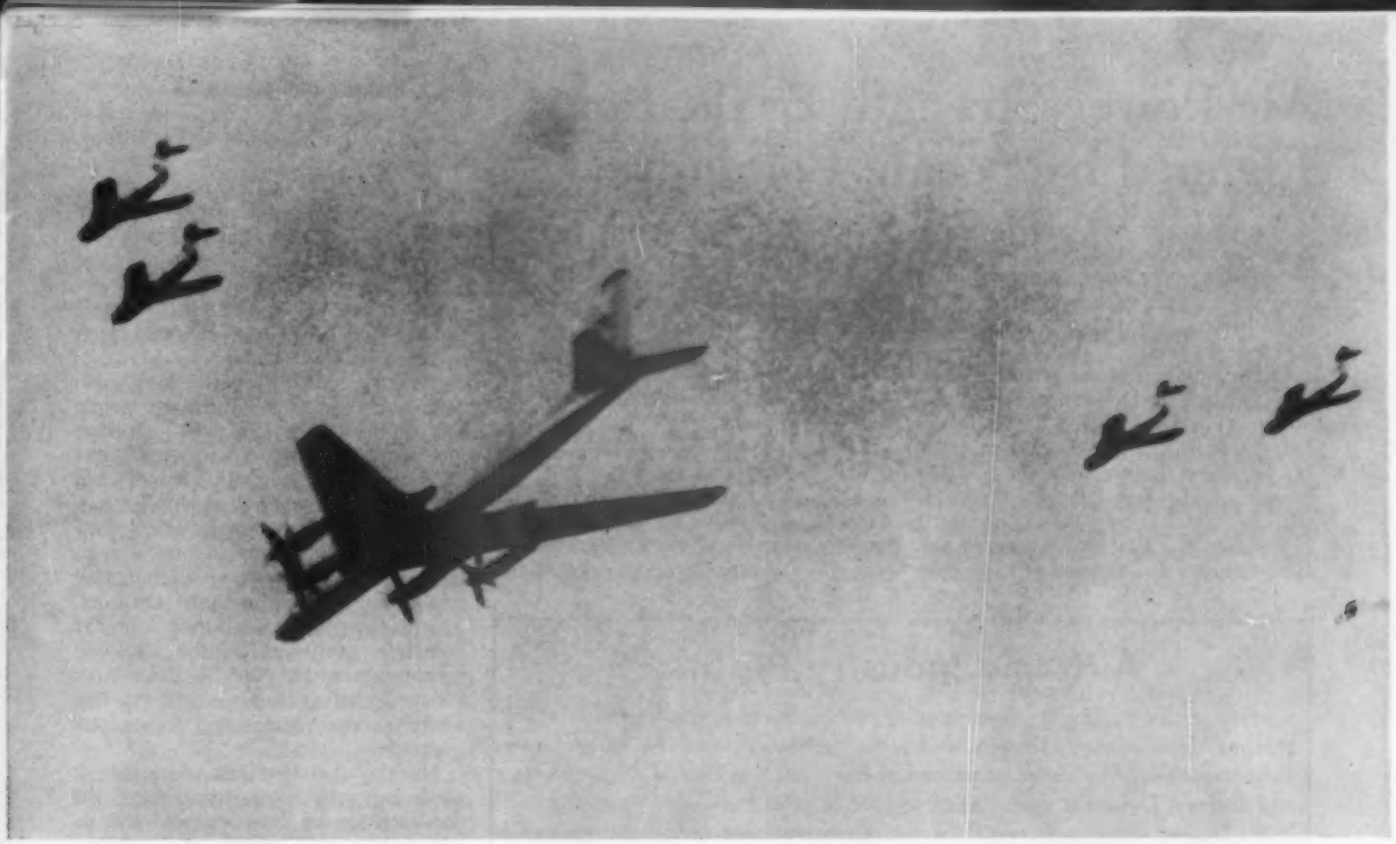
At the present time, the government has sponge production contracts with five companies. Production is expected to reach 8,000 tons this year and 22,500 tons capacity by 1957 of which 21,600 tons are at the present time under contract.

The five firms and tonnages involved are:

• **E. I. du Pont de Nemours and Co., 2,700 tons** plus 900 tons not under contract.

• **Titanium Metals Corp. of America, 3,600 tons.**

• **Cramet, Inc., 6,000 tons.**



BEAR TURBOPROP bomber shows tail gun turret; bombing radome under nose. Escorting MiG-17s show high tail design.

Russia Display Over Tushino

FLASHLIGHT all-weather fighter closeup shows large nose radome; wing anhedral.

New Russian aircraft pictures reaching Aviation Week from foreign observers were taken during the Tushino air display last July. The pictures reveal more detail on the latest Soviet fighter and bombers:

The MiG-17 Fresco fighters shown escorting a Bear turboprop bomber have a high horizontal tail design which was first shown in Aviation Week on March 14, p. 96. The Flashlight all-weather fighter appears to be a much larger plane than earlier pictures had indicated. The axial flow jet engines are mounted on short swept-forward pylons. The armament is located under the nose aft of the radome. The moderately swept wing is shoulder high on the fuselage and has considerable anhedral.

- **Union Carbide and Carbon Corp., 7,500 tons.**
- **Dow Chemical Co., 1,800 tons.**

Vance, in his report to Flemming, stated: " . . . I suggest that consideration be given to concentrating titanium substitution with one engine builder and to a given engine, with one airframe builder and to a given airframe, etc., rather than spreading a strictly limited program among so many contractors that each individual part thereof is, of necessity, experimental rather than production-wise in nature. Concentration will produce larger runs in forge shops, sheet mills, etc., and obviously better opportunity for substantial reduction in cost."

Vance also noted: "Within the past two years, the market price of sponge has dropped from $5 to $3.95 per pound (from $10,000 to $7,900 per ton). It is reasonable to expect that there will be further reductions during the next three years. Every price reduction automatically depreciates the resale value of government inventories. For example, reductions aggregating $1 per pound, if applied to an inventory of 30,000 tons, would cost the government $60 million."

Air Power Strength Evaluation Planned by Senate Committee

Washington—A broad inquiry "in an effort to evaluate the strength of the nation's airpower" is planned by the Senate Preparedness Investigating Subcommittee, headed by Sen. Lyndon Johnson (D.-Tex.).

Other members of the group are Sen. Estes Kefauver (D.-Tenn.), Sen. John Stennis (D.-Miss.), Sen. Stuart Symington (D.-Mo.), Sen. Styles Bridges (R.-N. H.), Sen. Leverett Saltonstall (R.-Mass.), and Sen. Ralph Flanders (R.-Vt.).

Pointing out that production of the B-52 bomber was stepped-up following displays of Russian developments in May (AW May 23, p. 12) and that "there is strong support for the production of greater numbers of advanced supersonic fighters and other new types of military aircraft," the subcommittee anticipated that "our need of these aircraft is not likely to diminish in the next several years."

Overall Inquiry

The subcommittee observed that "there has been a growing awareness across the nation of the increasingly destructive potential of air power and the latest budget and additional requests for funds for the Air Force has translated this awareness into action to provide greater expenditures for greater air power."

Upon releasing the subcommittee's first report on the profits of airframe manufacturers, Johnson explained the aspects of the overall inquiry it is launching in a letter to Sen. Richard Russell (D.-Ga.), chairman of the Armed Services Committee:

"We are presently gathering a considerable quantity of information giving the complete development, procurement, and production history and status of aircraft and aircraft engines and rockets and missile systems under production or development by the department of defense, together with complete information concerning production rates, quantities, and delivery schedules. Also included in our inquiry are the complete details as to the size and composition of the Navy air and the Air Force, including numbers and types of aircraft under present and future programming."

He also said that the committee is gathering information concerning the renegotiation of contracts and the remuneration paid officers and directors of military aviation firms.

Johnson noted that the first profits report is "solely factual" and is based on the reports of the airframe companies to the Securities and Exchange Commission. But he indicated that later the subcommittee might pass on "the reasonableness of the profits . . . and the efficiency and economy with which the companies have carried on their defense activities."

Profit Jump

The report showed that the profits of the airframe industry jumped from 8% of net worth, after taxes, before the Korean war to 29.4% last year, but profits on sales increased only slightly from 3% to 3.8%.

Other findings were:

- **Industry profits increased** from 12.6% of net worth, before taxes, in 1949, the year before the outbreak of the Korean war, to 60.1% in 1954.
- **Profits, before taxes,** on sales volume rose from 4.8% in 1949 to 7.7% in 1954.
- **Glenn L. Martin Co.** had the highest profits after taxes—72.9% of net worth and 7.4% of sales—in 1954.
- **McDonnell Aircraft Corp.** had the highest profits, after taxes, in 1949—48.7% of net worth and 6.3% of sales.
- **In 1944, the peak year of World War II,** industry profits amounted to 25.4% of net worth and 1.1% of sales, after taxes.
- **Industry profits dropped** to .1% of net worth and .1% of sales, after taxes, in 1945.

Airframe Industry Profits

Here are the profits, for percentage of net worth and percentage of sales, of airframe manufacturers reported on by the Senate Preparedness Investigating Subcommittee. The entire operations of firms—such as United Aircraft Corp. and General Dynamics Corp., also engaged in other businesses—are reflected in the figures. Curtiss-Wright Corp. which manufactured aircraft during World War II, was continued in the study although the firm is not presently in airframe production. Parentheses indicates minus figures or losses.

1944	Before Taxes		After Taxes	
Firm	Sales	Net Worth	Sales	Net Worth
Beech	8.5	143.9	2.4	41.1
Bell	4.3	144.4	1.0	31.9
Bellanca	17.8	120.0	4.4	29.6
Boeing	5.0	128.8	.9	22.2
Cessna	9.6	154.4	.6	42.3
Consolidated Vultee	6.4	199.9	1.3	4MR
Curtiss-Wright	5.5	148.3	.8	22.7
Douglas	3.3	76.1	.7	16.9
Fairchild	6.7	160.5	1.3	30.1
Grumman	9.5	453.3	1.6	77.0
Lockheed	3.	55.3	.8	13.6
Glenn L. Martin	6.0	105.5	1.0	17.2
Northrop	2.7	47.7	.7	12.0
North American	6.7	206.7	1.2	37.6
Piper	11.3	79.3	2.7	19.1
Republic	4.6	431.9	1.0	93.8
Ryan	7.9	110.3	1.8	24.6
United Aircraft Corp.	8.4	89.1	2.1	22.2
Combined Industry Totals	5.6	129.1	1.1	25.4

1945				
Beech	11.1	181.1	3.0	49.2
Bell	6.8	159.0	.7	38.7
Bellanca	9.8	68.5	3.1	21.5
Boeing	5.6	87.8	1.5	24.3
Cessna	9.7	59.2	2.4	14.8
Consolidated Vultee	3.8	59.2	1.0	16.2
Curtiss-Wright	7.5	127.4	2.0	34.9
Douglas	3.3	48.6	1.2	17.9
Fairchild	3.2	29.6	1.6	15.3
Grumman	8.8	196.2	2.4	53.9
Lockheed	1.0	11.8	1.3	15.3
Glenn L. Martin	14.5	170.7	6.2	73.2
Northrop	2.7	44.1	.9	14.0
North American	8.7	127.5	3.6	53.4
Piper	6.1	30.5	1.9	9.4
Republic	2.5	77.1	.7	20.7
Ryan	1.8	30.7	.6	10.5
United Aircraft Corp.	5.4	34.2	2.7	16.8
Combined Industry Totals	6.0	83.4	2.1	29.0

1949				
Beech	7.3	18.1	4.5	11.0
Bell	1.7	1.2	1.7	1.2
Bellanca	(56.)	(26.8)	(59.9)	(28.3
Boeing	2.8	18.1	1.5	10.0
Cessna	3.8	8.2	2.4	5.0
Consolidated Vultee	1.9	13.8	1.9	13.8
Curtiss-Wright	3.4	3.9	2.1	2.5
Douglas	9.1	14.4	4.7	7.4
Fairchild	5.8	18.1	3.3	10.2
Grumman	9.7	22.4	5.3	12.3
Lockheed	5.6	15.2	4.7	12.7
Glenn L. Martin	5.1	16.0	5.4	16.9
McDonnell	10.1	78.5	6.3	48.7
Northrop	(14.1)	(58.9)	(13.6)	(56.6)
North American	9.4	26.4	5.9	16.6
Piper	(1.9)	(3.3)	(1.9)	(3.3)
Republic	3.1	19.7	1.8	11.6
Ryan	3.9	14.0	2.4	8.6
United Aircraft Corp.	6.8	13.4	4.4	8.7
Combined Industry Totals	4.8	12.6	3.0	8.0

1954				
Beech	10.0	108.0	4.3	47.0
Bell	7.0	57.1	3.4	28.0
Boeing	7.4	93.3	3.6	45.0
Cessna	11.3	61.0	4.8	26.0
Chance Vought	9.4	80.9	4.4	38.2
Curtiss-Wright	8.3	31.3	4.1	15.4
Douglas	8.7	81.1	4.0	36.7
Fairchild	6.2	37.2	2.9	17.7
General Dynamics	6.8	139.0	3.2	65.9
Grumman	9.8	63.8	4.5	29.1
Lockheed	6.3	62.7	3.1	30.7
Glenn L. Martin	7.8	76.6	7.4	72.9
McDonnell	6.6	48.5	2.9	21.7
Northrop	5.2	71.4	2.2	30.8
North American	8.1	80.7	3.4	34.1
Piper	8.2	29.9	3.8	13.9
Republic	5.7	72.3	2.8	34.9
Ryan	9.6	60.8	4.3	27.6
United Aircraft Corp.	8.1	34.9	4.0	17.0
Combined Industry Totals	7.7	60.1	3.8	29.4

Jet Scientist Deported to China

Los Angeles—Dr. Hsue-shen Tsien, former head of the Jet Propulsion Center at the California Institute of Technology, was scheduled to be deported to Communist China Friday as an alleged former Communist.

Dr. Tsien, a noted rocket expert, also had served as consultant to the Aerojet-General Corp., which is active in almost every U.S. guided missile program before his arrest in 1950 as an alleged member of the Communist party.

After his conviction and while awaiting deportation on the charge, Dr. Tsien returned to his Cal Tech post under $15,000 bond.

Cal Tech authorities said last week that the Guggenheim Jet Propulsion Center is concerned with non-military research, while its Jet Propulsion Laboratory deals in military applications of jet and rocket research.

Another Chinese scientist, Dr. David K. Wang, an engineer assigned to key rocket projects at Aerojet-General, also was given permission to return home but declined last week, declaring, "I don't want any part of Red China."

Dr. Wang, who worked on development of the Nike missile, has applied for a permanent resident permit.

Although the order for the deportation of Dr. Tsien was issued in 1950, it was not officially executed until Aug. 4. At that time, the Chinese rocket specialist resigned from his Cal Tech post to prepare for his return to China.

Identified at his hearing by two members of the Los Angeles Police Department as a card-carrying Communist in the 1930s, Dr. Tsien testified that he was not a Communist and had never been one.

The deportation order was issued in September, 1950. In the delay that followed, Dr. Tsien returned to his post at Cal Tech.

Delay of execution of the order has not been explained officially, but presumably the U.S. was not anxious to have the scientist return to China with his research secrets.

Dr. Tsien established an outstanding reputation for brilliant work in aerodynamics, especially in the mathematical analysis of basic problems of high velocity phenomena and strength of materials. During World War II, he was a member of the Scientific Advisory Board of the Army Air Force.

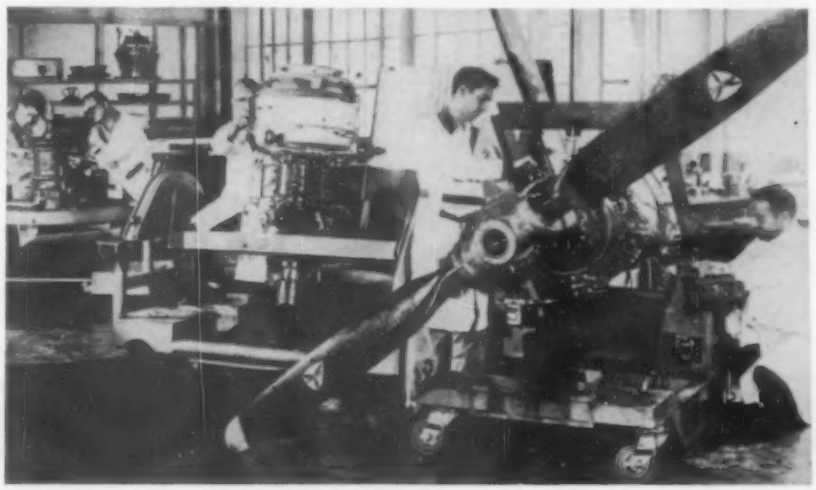
As head of the Guggenheim Jet Propulsion Center, he had been working on fundamental research of jet propulsion problems. The center provides facilities for post-graduate education in research of jet propulsion and rocketry with particular emphasis on peacetime uses—especially in the fields of fluid mechanics of turbo machinery, basic combustion problems, gas emissivities, application of modern spectroscopy to detailed analysis of combustion and theory of the control and guidance of complex systems.

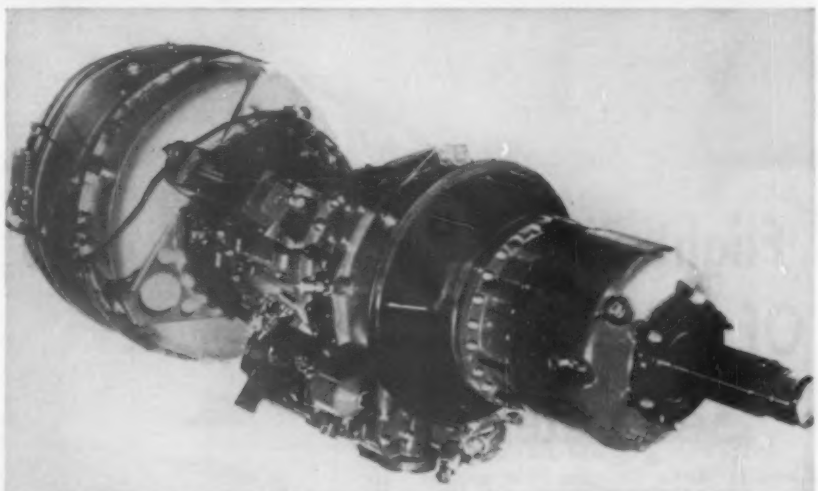
USAF Missile Cable

Continuous study by the Air Force of guided missiles in flight over an extended range is now possible with the installation of the world's longest undersea telephone cable stretching 1,575 mi. from Cape Canaveral, Fla., to a point near Mayaguez, Puerto Rico.

USAF accepted the cable last week. Installed by the Western Electric Co. over a four-year period, the cable will serve as a communications "spinal cord" for the range which extends 5,000 miles from Florida into the South Atlantic Ocean. It will automatically transmit signals on the performance and progress of guided missiles.

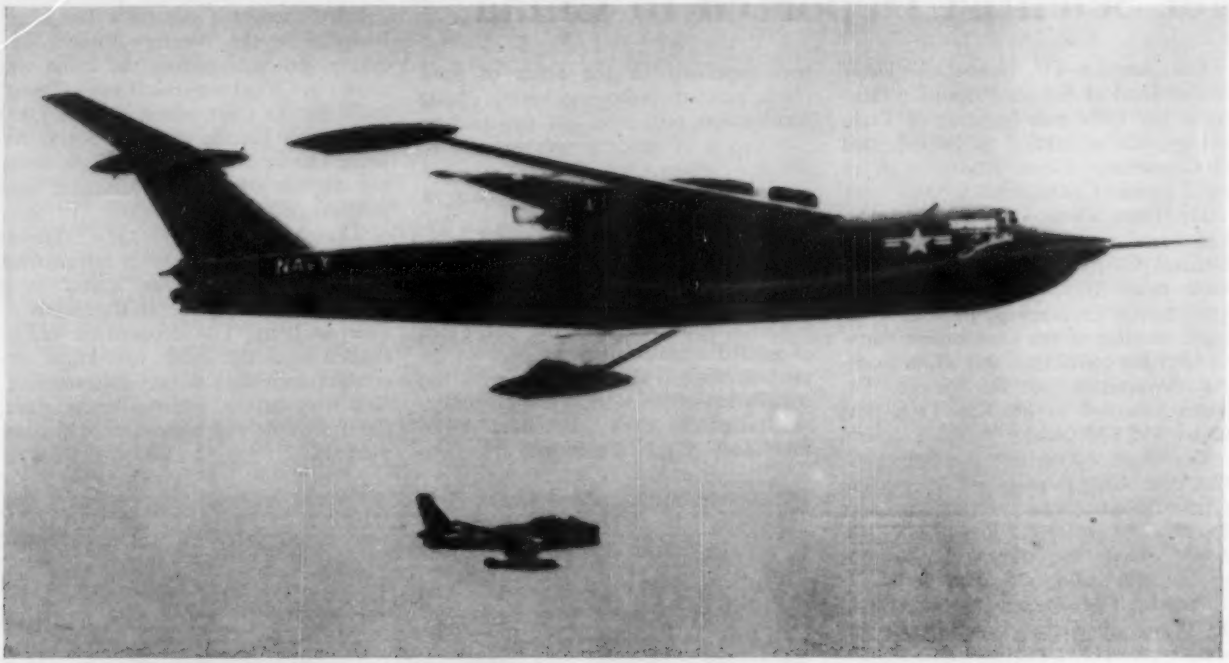
The Air Force said radar stations along the route will gather information sent by radio from the missile as it passes over the range at thousands of miles an hour. The information will be flashed over the cable to Florida, recording such data as fuel consumption, skin temperature, internal temperature, flight attitude and performance of components.

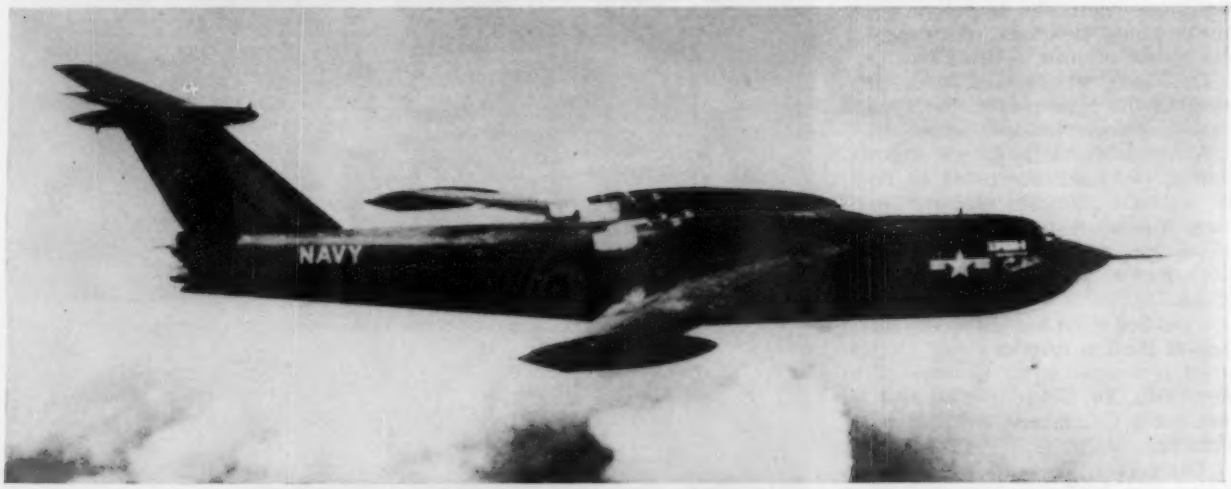




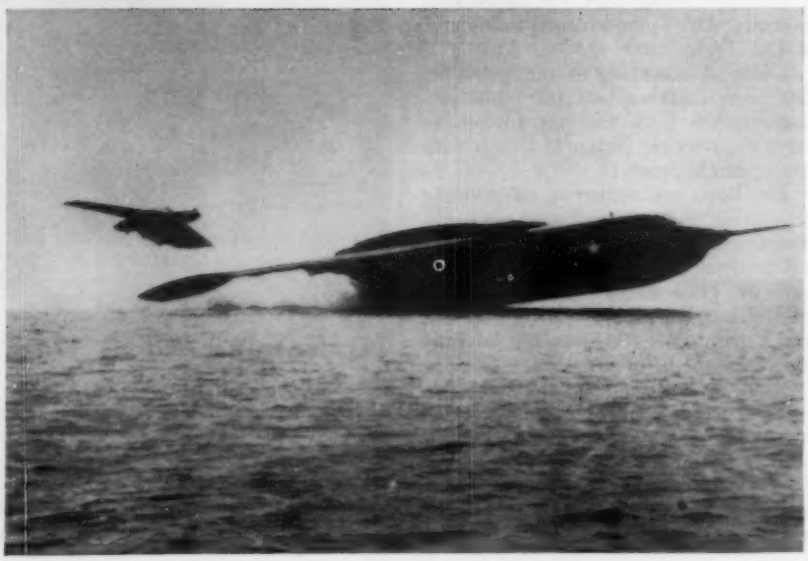
Lycoming XT53 Has Copter, Turboprop Uses

New Lycoming XT53 turbine, rated at 825 hp., is adaptable to both helicopter use and as a turboprop. In the former case, it will power Bell's new XH-40 utility copter for the Army. It is also being studied by the newly-formed Frye Corp., of Ft. Worth, Tex., for possible use on the new F.1 four-engine feederliner (see p. 7). Top view shows engines in experimental assembly. Powerplant in foreground is fitted with a 10.5-ft. propeller. Lower view also shows turboprop version. XT53 features a front-end drive; can also have rear or simultaneous front-and-rear power extraction.





Flight Pictures Of Martin P6M SeaMaster



Glenn L. Martin Co. giant P6M seaplane is shown in flight test over Chesapeake Bay near Baltimore. Navy's FJ-2 Fury is the accompanying chase plane. SeaMaster cruises normally at 40,000 ft. carrying a payload of 30,000 lb. according to Martin officials. Hull contains water-tight rotary mine door on which naval mines or camera pod can be installed interchangeably. Note tail turret armament; aero-elastic wing; and unusual spray pattern on take-off.

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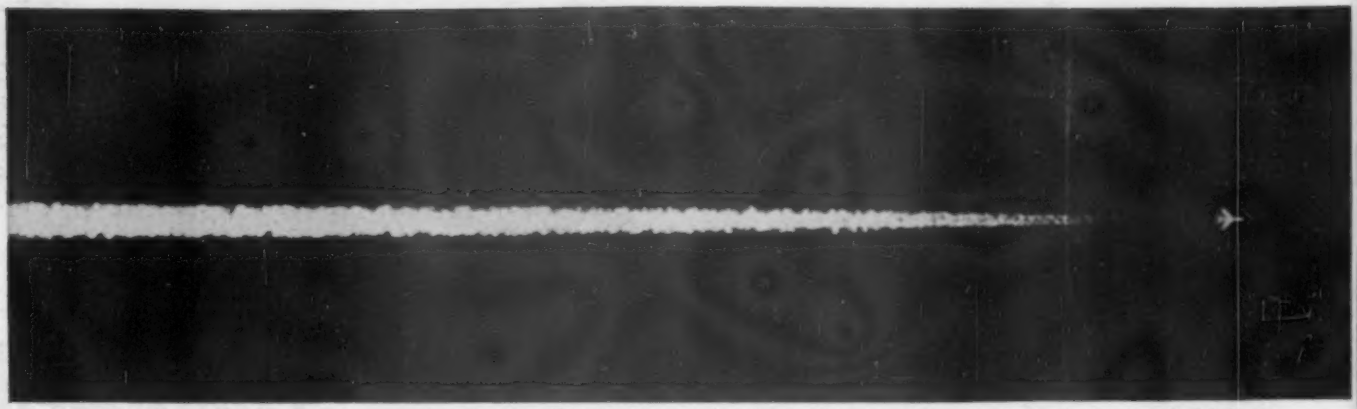

40,000-FT. UP, F-100C begins Thompson Trophy run (Note 'starting wire' at right). Picture was taken by timing device described below.

New Device Times Trophy Speed Run

The new world's speed record of 822.135 mph. established by Colonel Horace A. Hanes in his Thompson Trophy Flight was recorded and verified by almost equally-new timing equipment designed by North American Aviation, Inc. to meet the demands of high-speed jets. Here's how the system operated:

At each end of the 18-kilometer Palmdale, California, course used in the test, two horizontal wires were strung between two aluminum towers and above a vertically pointed camera. The camera was aligned so that the two wires appeared to be superimposed on a resulting photograph (above).

Each camera, equipped with a telescopic tracking sight, recorded the position of Col. Hanes' F-100C in respect to the ends of the course.

The camera at the start triggered an electronic counter chronograph at the same instant that it photographed the speeding aircraft.

As the plane crossed the finish line, the second camera recorded its position and simultaneously stopped the counting of the chronograph. The elapsed time in seconds was read to five decimal places.

In order to obtain photographic data required by the Federation Aeronautique Internationale for an official record, North American engineers had to develop a method of double exposing the film so that the airplane at 40,000 ft. and the cables stretched between the towers were both in focus. (The National Aeronautic Association already has certified Hanes' mark of 822.135 mph.—the average of a 870.627 mph. southwest to northeast run and a 733.644 mph. northeast to southwest run, as a world's record.)

The complete camera includes a coated Bausch and Lomb telestigmatic lens with a focal length of 40 in. and maximum aperture of f/8, a Speed Graphic camera back and an electrical solenoid. The counter chronograph is a Potter instrument which measures time in ten millionths of a second.

SPECIAL telescopic camera used in recording F-100C's Thompson Trophy Flight.

In addition to the photographic and electronic equipment, official observers on the ground and in two T-33 jet trainers monitored each end of the course. The record plane carried barographs for verification of altitudes and two calibrated altimeters and a stop watch synchronized with those of observers on the ground, which were photographed continuously during the speed runs.

The new measuring equipment is expected to be in use for some time. Industry and Air Force officials alike are hopeful that it will prove adequate for measuring the even faster supersonic jet flights of the future.

Temco's Net Earnings

Temco Aircraft Corp. reported net earnings of $1,402,990 for the first six months of 1955, 5.9% higher than $1,325,160 for 1954's mid-year. Sales totaled $37,326,665, a 44.9% increase over $25,754,359 for the same period last year.

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Small Businesses Get $3-Billion in Aircraft Contracts During 1954

Washington—More than $3 billion of aircraft components and accessories were supplied by small business firms employing fewer than 500 persons in 1954, according to a survey by the Aircraft Industries Assn. The study covered 35 major manufacturers of airframes, engines and components.

More than two-thirds of the total—$2.03 billion—was paid direct to small business by the aircraft industry. The figure compares with $2.7 billion paid to large business for similar goods and services.

The total small business share exceeded the $3 billion mark by orders from second, third and fourth tier suppliers.

A substantial percentage of the $2.7 billion spent with large firms was for supplies and products of a proprietary nature or which can be produced only by companies with a large capital investment. Second, third, and fourth tier aircraft supply and subcontracting purchases are estimated at approximately $750 million.

High Business Level

In addition, small business concerns received several hundred million dollars worth of aircraft manufacturing business from prime contracts with the Air Force and Navy Bureau of Aeronautics. Indications are that the current level of small business activity is higher than any period since World War II, when nearly all American industry was engaged in military production of one type or another.

In the AIA survey, each of the participating companies was asked to provide its list of suppliers and subcontractors.

These lists were then cross-checked to eliminate duplication. Since not all the participants in the survey maintain records of this type, this element of the survey was limited to 21 of the 35 companies.

Elimination of duplications from the lists of subcontractors and suppliers provided by the 21 reporting companies revealed that they did business with 34,623 different firms in 1954. Of this number, more than 28,000 or approximately 81% were classed as small business. These firms were located in all the 48 states and in 18 foreign nations.

California, with 10,314 companies contributing products or services used in aircraft production, led the list of states followed by Ohio with 4,487; New York with 3,382; Texas with 1,615; and Connecticut with 1,513.

AIA estimates that the 14 companies which did not provide lists would have added approximately 15,000 additional firms bringing the total number of subcontractors and suppliers involved in the program to approximately 50,000. Small business firms, 41,700 in number, comprise about 83% of the total.

The compilation of the unduplicated list of suppliers and subcontractors disclosed:

• **Approximately 300 companies,** basically manufacturers of patented components or items of equipment, appeared on every individual company list.

U. S. Suppliers by States

California	10,314
Ohio	4,487
New York	3,382
Texas	1,615
Connecticut	1,513
Illinois	1,433
Pennsylvania	1,421
Washington	1,316
Michigan	1,275
Maryland	983
New Jersey	937
Massachusetts	932
Minnesota	841
Missouri	834
Kansas	638
Indiana	360
Arizona	318
Wisconsin	257
District of Columbia	209
Florida	128
Oklahoma	116
Rhode Island	113
Oregon	94
Iowa	66
Tennessee	56
Kentucky	53
Colorado	51
Virginia	51
Georgia	35
New Hampshire	33
Nebraska	32
North Carolina	28
New Mexico	26
Delaware	23
West Virginia	17
Alabama	16
Vermont	15
Maine	12
Louisiana	10
Arkansas	8
Mississippi	6
Utah	6
South Carolina	4
Montana	3
Nevada	3
Idaho	2
South Dakota	2
Wyoming	2
North Dakota	1
Undesignated	441

• **Several thousand subcontracting and** supply companies provided goods to more than one prime manufacturer.

• **Thousands of companies** classed as small business, were in receipt of contracts from more than one of the prime manufacturers.

• **A substantial volume** of the nation's aircraft manufacturing activity has been dispersed from accustomed industrial centers.

With aircraft production gradually declining toward the level designed to maintain our military air arms, AIA says the amount of business being awarded to outside sources also is diminishing. During this year, however, the volume of aircraft business to be performed by suppliers and subcontractors, including those in the second, third, and fourth tiers, is expected to be well over the $2 billion mark with only a further moderate decrease anticipated for 1956.

Although the dollar volume of the aircraft production subcontracting and supply program is expected to continue to decline and some firms will be dropped, the survey showed substantial opportunities for new aircraft production orders will be available to competent, efficient, low-cost manufacturers, large and small.

Stiff Competition

One result of the reduction in aircraft production is the change in the philosophy of procurement officials, AIA says. New importance is attached to quality, product reliability, and to low-cost production. As a result, competition for major contracts among the various prime producers has been intensified.

In many instances, the survey disclosed small firms are able to fabricate some parts and components, faster, better, and cheaper than the prime contractor himself. Such firms will receive business from the aircraft industry regardless of the overall level of the aircraft procurement program, according to AIA.

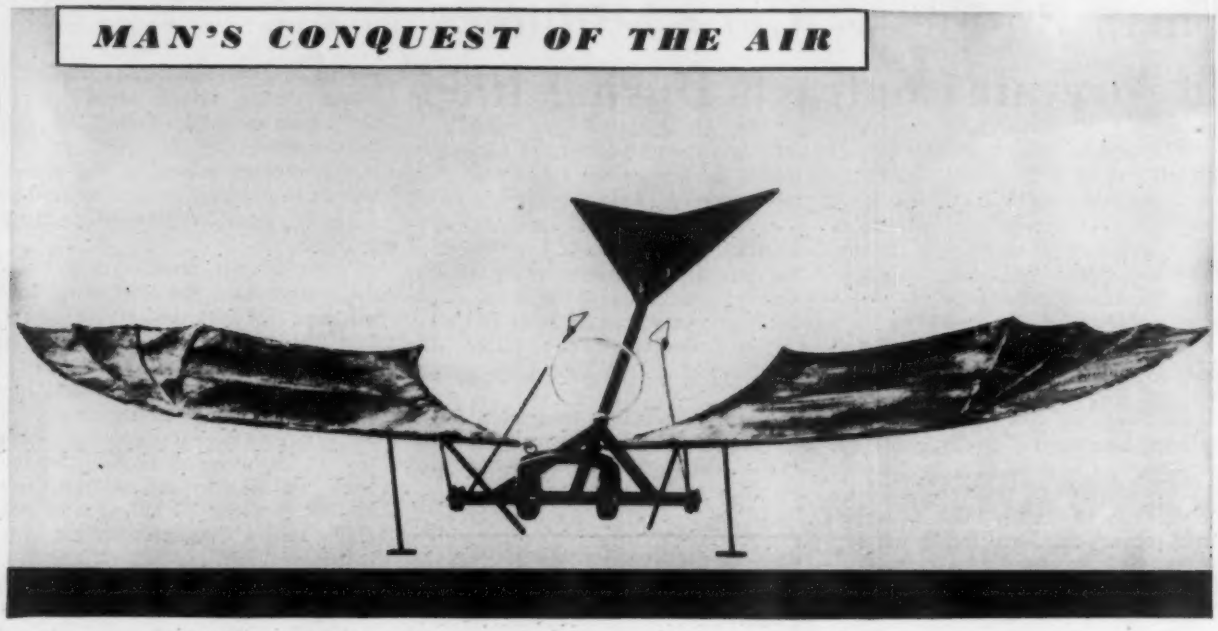
Before a potential subcontractor's facility can be properly evaluated, the prime contractor needs the following data as to the capabilities of the subcontractor to perform various types of work, AIA says.

• **Type of work** the company is prepared or equipped to perform, including reference to any previous experience in aircraft work, such as World War II subcontracting, or any other experience with the Air Force, Navy, or Army.

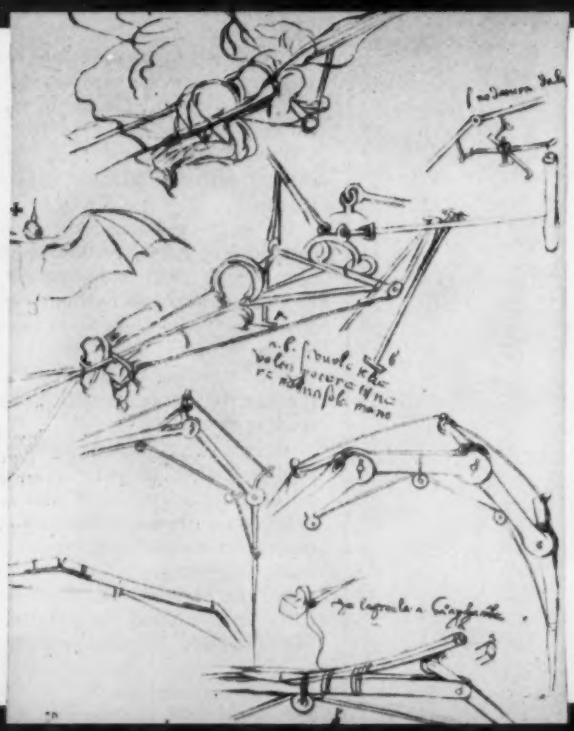
• **Size and location** of the plant or plants, including amount of floor space for production, the size of the bays or other subdivisions, strength of floors, the dimensions of the outlets.

• **A complete list and description,**

MAN'S CONQUEST OF THE AIR



First Plans for Mechanical Flight



"If I find that this instrument made with a screw be well made — that is to say, made of linen of which the pores are stopped up with starch — and be turned swiftly, the said screw will make its spiral in the air and it will rise high."

These are not words of a visionary but the careful notes of the man who gave the world its first detailed plans for mechanical flight — Leonardo da Vinci. Over 400 years ago he made a careful scientific investigation of the mechanics of bird flight, planned in detail the helicopter and parachute, and constructed many test models of flying machines. Always seeking improvements, he died with his work unfinished.

"There shall be wings!" da Vinci declared. "If the accomplishment be not for me, 'tis for some other." Today we have those wings and like da Vinci, keep trying to improve the ways we fly. With the same spirit ESSO research continues to supply today's new and better aircraft with new and better aviation petroleum products.

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including makes, sizes, model number and capacities, of all the power machinery and equipment available, including that on order with expected delivery dates, identified by factory number, and noting its age and condition. Types of processing, treating plating, or welding facilities. Facilities available for inspection should be listed as should any facilities available for research.

• **Total employes** including breakdown of production and other employes, principal officials, proportion of skilled to unskilled workers, special skills, wage scales and labor resources.

• **Bank and credit references.**

• **Facilities for plant security,** transportation facilities—rail and highway network, and plant freight handling facilities—technical background, capacity available for additional work, and of course, the names and addresses of both office and plant.

Employment Slips 3% in June

Employment in the aircraft manufacturing industry for June was 737,500 employes, a 3.6% reduction from the same month in 1954, Bureau of Labor Statistics reports.

Included in total employment were 503,400 aircraft production workers, down 7.2% from 542,700 employed in June 1954. Employment of production workers in all segments of aircraft manufacturing declined in June from the same month a year ago with the biggest decline shown in engines, propellers and other aircraft parts.

The workweek remained constant at 40.9 hours but there was an increase in the average weekly earnings of aircraft production workers to $87.94 in June. Average hourly earnings moved up to $2.15, a gain of 7 cents an hour over the $2.08 hourly rate recorded in June 1954.

Tar Paving For Jet Age

A new tar-rubber paving called Jetlock resists the softening effects of jet fuel on standard asphalt runways. The fine-grained powder, made of synthetic rubber and barytes, is hot-mixed with tar to produce a blend which is spread over an asphaltic base.

Over 72,000 square yards of the paving has stood up well under constant testing at West Palm Beach AFB. Produced by Rubarite, Inc.—a company jointly owned by Goodyear Aircraft Corp., The National Lead Co., and Bird & Son, Inc.—the rubber powder provides a uniformly tight bond, is easy to handle.

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• quickly re-worked for parts changes

Already in use by the leaders of the jet engine industry, this new kind of guillotine gage solves the problem of maintaining accuracy. Templates are supported over a much larger area of their surface, making wear negligible. And alignment is guaranteed by heavy stacked towers that are bolted together for ruggedness and complete rigidity. Winslow's new design and assembly from precision-built interchangeable parts give six big advantages. You get quick delivery and lower original cost. You save on maintenance—in case of damage substitution of some parts can be made without even removing the gage from your inspection line.

Gage down-time is cut, requiring fewer gages and avoiding costly production holdups. And finally, you reduce your gage investment with a truly multi-purpose instrument—check all 10 features of a jet engine blade with a single gage; check forging and finished part with only one gage. No more gage obsolescence—Winslow's Re-Work Service quickly up-dates the gage when your part changes. Easy to use and easy to read, the Winslow speeds production, gives "more accuracy for less money."

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AVRON One-Way Restrictor Valves. Available with either male or female AND type connections. Restricted flow rates from 0.07 Gals/min to 11 Gals/min for any operating pressure up to 3,000 psi. Recommended for hydraulic fluids, oils, gasoline, and other fluids non-corrosive to steel and aluminum.

Also AVRON Two-Way Restrictor Valves, 3,000 psi
High-Pressure Bleeder Valves, 3,000 psi
Low-Pressure Relief Valves
Absolute-Pressure Relief Valves

Lockheed Chief Test Pilot Blasts 'Out-of-Date' Safety Conditions

Los Angeles—Lockheed Aircraft Corp.'s chief engineering test pilot, Herman (Fish) Salmon, has charged that present measures to protect the pilots of supersonic aircraft are inadequate and at least five to ten years out of date.

Speaking at an Aviation Writers Assn. meeting, Salmon who recently bailed out of Lockheed's supersonic F-104, urged the Air Force and industry to give more attention to pilot protection when designing aircraft for supersonic flight.

"I'm not talking for myself," Salmon said, "but for all engineering pilots."

Ironically, his plea for safer conditions for pilots came less than 36 hours before Lockheed test pilot Stanley A. Beltz was killed in the crash of his F-94B jet while on a flight over the Mojave desert.

"Engineers are making their airplanes faster than Hell," Salmon said," "But the human-factors people haven't had the money and the help to do the job necessary for the pilot."

Pointing out that an aircraft such as the Lockheed F-104 is capable of extremely high speeds and altitudes, its test pilot asked:

"What happens if something gives away and the pilot had to get out at that speed and altitude? His chances are damn slim."

Noting that research aircraft altitudes are topping 90,000 ft. with production aircraft "not far behind," Salmon said the military services do not have a good full pressure suit and that the T-1 partial pressure suit is a "nightmare."

"I can't say it's no good," he added, "It's the only thing we have."

He listed these dificiencies in the suit:

- **At 65,000 ft., it doesn't work**—"You just die, there's no doubt about it."
- **It is uncomfortable**—"It beats you up, inflated or uninflated."
- **There are gaps in the protection it affords**—"Certain parts of you would just swell up."
- **It is good for only** six minutes inflated.
- **Heating Wires** in the face plate distort vision.

"I am not condemning the suit," Salmon said, "I am convinced in my own mind that it saved me twice. I probably wouldn't be here without it. But it is not the ultimate."

The veteran test pilot urged that more funds be devoted to the study of pilot problems.

Salmon lauded the human factors work of the Air Research and Development Command but said greater financial support is needed at the present time.

"We need all the help we can get from engineering people and medical people," he said. Without this effort, he predicted, it will be increasingly difficult to interest youngsters in military aviation.

Large Irregular Case

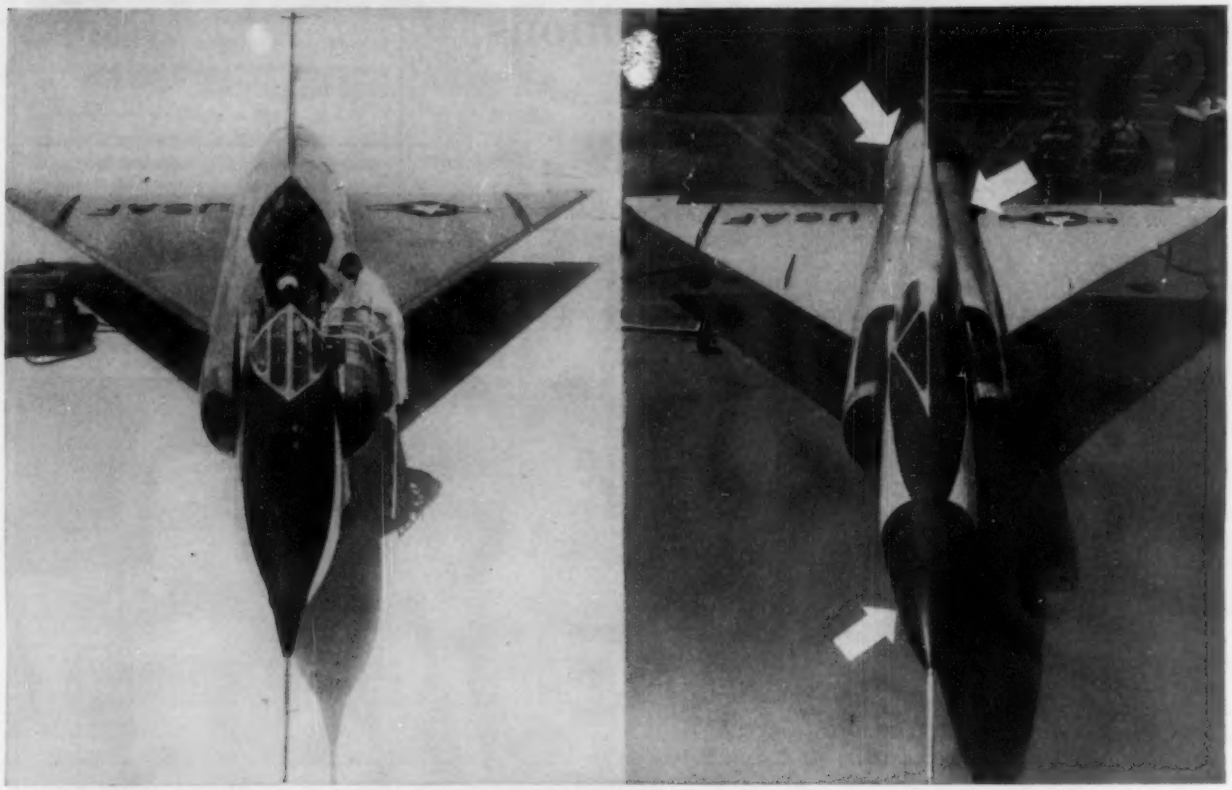
Civil Aeronautics Board has decided to continue hearings on the qualifications of irregular carriers while deciding on the Large Irregular Case.

While CAB is deciding the place of the irregular airline in the air transport pattern, the record is reopened for examinatioa of individual carriers on their fitness to render whatever service CAB decides to allow.

Actually, 30 of the 60 carriers in the case were heard before CAB limited hearings to the general issues 18 months ago.

Heliocopter Television

Air-to ground television transmission tests using a helicopter-borne camera are being conducted by the Bristol Aeroplane Co. Top picture shows Pye TV camera installed aboard a Bristol Sycamore; bottom, television picture of assembly hall where Britannia airliners are being built as recorded by the airborne camera.



F-102A BEFORE and after area-rule application. Changes include longer nose, indented fuselage and bulged tail section.

NACA Details Area Rule Breakthrough

By Richard T. Whitcomb

Comparisons have been made of the shock phenomena and drag-rise increments for representative wing and central-body combinations with those for bodies of revolution having the same axial distributions of cross-sectional area normal to the air stream. On the basis of these comparisons, it is concluded that near the speed of sound the zero-lift drag-rise of a thin low-aspect-ratio wing-body combination is primarily dependent on the axial distribution of the cross-sectional areas normal to the air stream. It follows that the drag-rise for any such configuration is approximately the same as that for any other with the same distribution of cross-sectional areas.

Investigations have also been made of representative wing-body combinations with the body so indented that the axial distributions of cross-sectional areas for the combinations were the same as that for the original body alone. Such indentations greatly reduced or eliminated the zero-lift drag-rise increments associated with the wings near the speed of sound.

In the interpretation of the zero-lift drag-rise characteristics of configurations near the speed of sound, the transonic similarity rules and linear theory have been applied in limited analyses. However, no general means is available for directly explaining quantitatively the variations of the transonic drag-rise associated with the numerous changes in wing plan form and section considered by airplane designers (Ref. 1, for example), even for the simplified case of a wing alone. More important, even a qualitative understanding of the large and highly variable zero-lift drag interferences associated with practical combinations of wings and bodies near the speed of sound (Ref. 2, 3, and 4, for example) has been lacking. A logical means for interpreting the drag-rise values for thin low-aspect-ratio wing-body configurations is discussed herein.

The results presented in Reference 5 indicate that for a representative swept-wing and central-body combination, the zero-lift drag-rise is due primarily to shock losses. A study of these results also indicates that the shock formations about this relatively complex configuration at zero lift near the speed of sound are similar to those that would be expected for a body of revolution with the same axial distribution of cross-sectional area normal to the air stream. (The probable shocks for such a body were estimated on the

Special Service

Because of the limited confidential distribution of the orginal National Advisory Committee for Aeronautics' report on Richard T. Whitcomb's revolutionary area-rule discovery in the field of supersonic aircraft design, Aviation Week is herewith printing the report in full, along with the accompanying charts and tables, as a special service to its many engineer readers and others. The report bears the official title of NACA research memorandum L52H108 "A Study of Zero-Lift Drag Rise Characteristics of Wing-Body Combinations Near the Speed of Sound." Confidential classification of this report, which had been in effect since it was written on Sept. 3, 1952, was removed by the NACA last week.

basis of the flow surveys presented in Ref. 6.) Further, the drag-raise characteristics for this wing-body combination at zero lift are about the same as those for a body of revolution (Ref. 7) with approximately the same axial distribution of cross-sectional area. On the basis of these facts and a preliminary consideration of the general physical nature of the flow about configurations, is has been reasoned that near the speed of sound the zero-lift drag-rise of a wing-body configuration generally should be primarily dependent on the axial distribution of the cross-sectional areas normal to the air stream.

In order to ascertain the soundness of this concept, measurements have been made of the flow fields and drag-rise characteristics for four representative wing–central-body combinations and for bodies of revolution with the same axial distributions of cross-sectional area normal to the air stream. The results, obtained at Mach numbers from 0.85 to 1.10 in the Langley 8-foot transonic tunnel, are compared and analyzed herein. In order to illustrate possibilities for improving airplane performance at transonic speeds, zero-lift drag coefficients for three special wing-body combinations are also presented.

Configurations

Basic bodies. The major part of the results discussed herein were obtained for three wings in conjunction with the body of revolution shown in Figures 1 (A), 1(B), and 1(C). The body is normally cylindrical in the region of the wing and has a fore-body of the same shape as that of the body described in reference 5. The radii of the cylindrical body are listed in table I. The swept wing of the group was also investigated in conjunction with the body with a curved afterbody as shown in Figure 1 (D). This combination is identical with that of Reference 5. Radii of the curved body are also listed in Table I. The maximum diameter of this curved body is somewhat less than that of the cylindrical body.

Wings. The wing for which the most extensive results were obtained has O deg. sweep of the quarter-chord line, an aspect ratio of 4.0, and a taper ratio of 0. The streamwise sections of the wing are symmetrical, 4 percent thick, and consist of circular arcs with the maximum thickness at the 40-percent-chord stations. This configuration (Fig. 1 (A) is referred to as the "unswept" wing. Results were also obtained with this wing reversed so that the 75 percent chord line is unswept, as shown in figure 1 (B). The leading-edge sweep of this wing is 37 deg. This configuration is very nearly of delta plan form and is referred to as the "delta" wing. Finally, investigations were made with a wing which has 45 deg. sweep of the quarter-chord line, an aspect ratio of 4.0, a taper ratio of 0.6, and an NACA 65A006 airfoil section parallel to the air stream. This configuration (Figs. 1 (C) and 1 (D) is referred to as the "swept" wing.

Special bodies: Bodies of revolution with the same axial distributions of cross section as the wing-body combinations were obtained by altering the original bodies. The radii of these revised bodies of revolution are listed in Table II. Especially indented bodies of revolution were investigated in conjunction with the three wings and these bodies were also obtained by altering the original cylindrical body. The radii of these bodies in the region of the wing are listed in Table III.

Measurements

Schlieren surveys were obtained with the temporary Schlieren system described in Reference 6. In order to obtain side-view Schlieren surveys of the fields at distances from the model center lines with the horizontal, symmetrically oriented Schlieren system, the various models were displaced downward from the center line of the tunnel. In every case the displacement for the comparable bodies of revolution were the same as for the wing-body combination. Plan-view Schlieren surveys for the unswept-wing–body configuration were obtained by rotating the model 90 deg. and displacing it farther from the center line of the tunnel. Wall Mach number distributions were obtained from pressures measured at the rows of orifices placed along the center lines of panels of the test section adjacent to the top and bottom panels. For the side-view Schlieren surveys the distances from the model center lines to these stations were 35.5 and 52.8 inches. For the plan-view surveys, they were 31.2 and 58.0 inches. Drag measurements were obtained by internal strain-gage balances. Base pressures were also measured.

Presentation of Results

Detailed flow surveys. Composites of the Schlieren photographs and wall Mach number M_w distributions for the unswept wing and cylindrical body combination, the comparable body of revolution, and the cylindrical body alone are presented for several stream Mach number M_∞. The Schlieren photographs shown above the center lines of the outlines of the three configurations present side views; those below the center line of the wing-body configuration present plan views. The plan-view Schlieren surveys for the wing-body configurations were not duplicated for the bodies of revolution. The relative orientation and sizes of the photographs with respect to the outlines are the same as those of the Schlieren fields with respect to the test model.

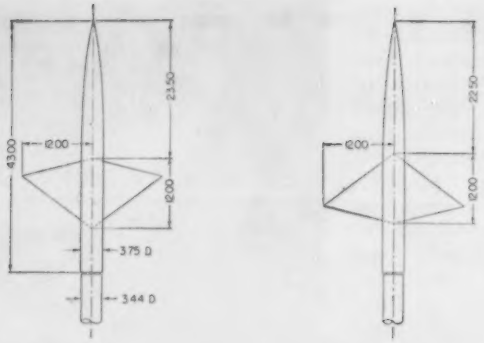
Richard T. Whitcomb, 34, joined the research staff of NACA in March 1943 after graduating from Worcester Polytechnic Institute "with high distinction." Assigned to the 8-ft. High-Speed Wind Tunnel, he specialized in highspeed flight problems and advanced to his current position as assistant head of the 8-ft. Transonic Tunnels Section.

Whitcomb is one of the principals credited with the conversion of the 8-ft. tunnel to a transonic facility; specifically, he contributed the design of a mechanical device which reduced power requirements of the tunnel.

After helping thus to build the tool he needed for the job, Whitcomb organized and directed the basic research into the problem of the transonic drag rise. The area rule concept grew directly out of that work.

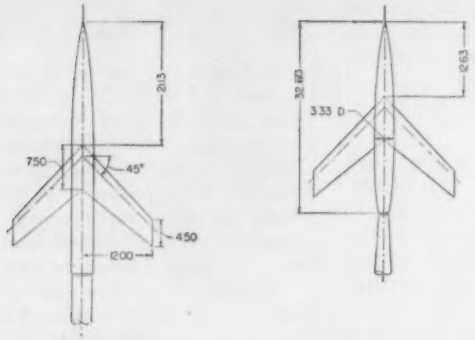
The wall Mach number distributions shown at the tops of the composites for the three configurations were obtained during side-view Schlieren surveys, those at the bottoms of the composites for the wing-body combination are from plan-view surveys. The two Mach number distributions presented on a given set of ordinates are for the two measurement stations. The Mach number distributions are placed on the composites so that the distances from the center line of the model to the M_∞ points on the Mach number scales are equal relatively to the distances from the model to the lower-wall Mach number measurement stations. The horizontal scale of the wall Mach number distributions is the same as that for the model outline

The stream Mach numbers M_∞ at which the various Schlieren pictures and various wall Mach numbers distri-



(a) Unswept wing, cylindrical body.

(b) Delta wing, cylindrical body.



(c) Swept wing, cylindrical body.

(d) Swept wing, curved body.

FIGURE 1 - Wing-body combinations used in investigation. All dimensions are in inches.

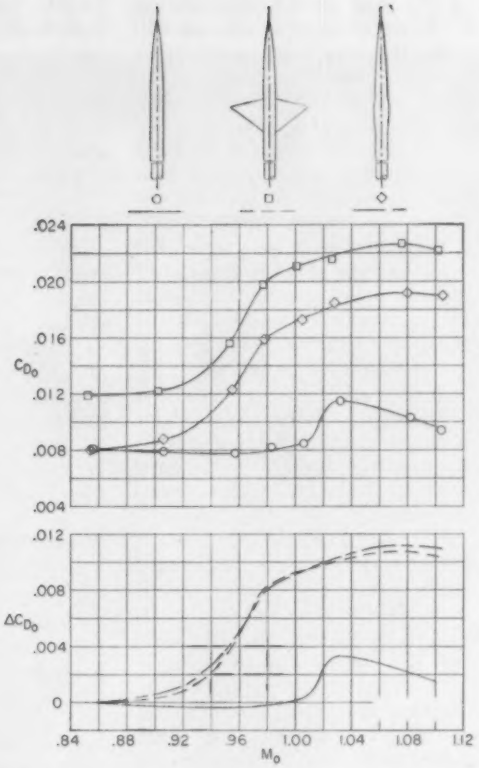


FIGURE 3 Comparisons of the drag rise for the unswept-wing and cylindrical-body combination with that for the comparable body of revolution and the cylindrical body alone.

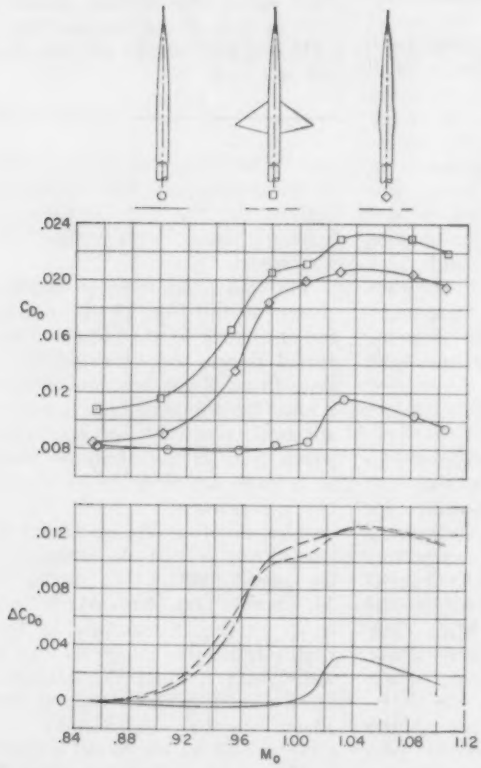


FIGURE 5 Comparisons of the drag rise for the delta-wing and cylindrical-body combination with that for the comparable body of revolution and the cylindrical body alone.

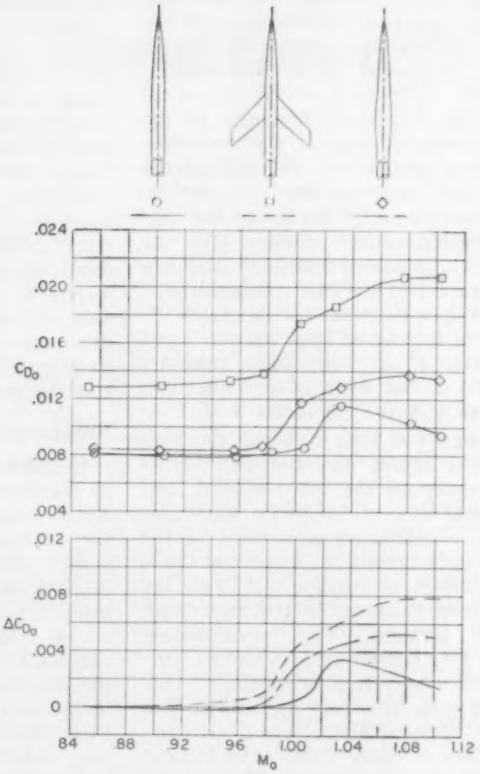


FIGURE 7 Comparisons of the drag rise for the swept-wing and cylindrical-body combination with that for the comparable body of revolution and the cylindrical body alone.

butions were obtained varied by as much as plus or minus 0.005 from the mean values for each of the composites. However, the maximum difference between the stream Mach number for the directly comparable side-view photographs for the wing-body combination and the comparable body of revolution was approximately 0.003.

Drag coefficients. The zero-lift drag coefficients CD_o for the wingbody combinations, the comparable bodies of revolution, and the basic bodies alone as prepared in the various figures such as Figure 3, are all based on wing areas of 1 square foot. These coefficients have been corrected to a condition at which the base pressure is equal to the stream static pressure. The drag coefficient increments delta CD_o as presented in Figure 3, have been obtained by subtracting the drag coefficient values measured at a Mach number of approximately 0.85 from those measured at the higher Mach numbers. This subtraction nearly eliminated the effects of differences in the skin friction of the comparable configurations on the comparisons of the drag characteristics for these configurations.

The maximum error of the absolute drag coefficients presented is approximately plus or minus 0.0005. Time effects of wall-reflected disturbances, as described in Reference 6, an the drog results have been essentially eliminated at all Mach numbers except those near a value of about 1.05. This has been accomplished by displacing the model from the tunnel center line (Ref. 6), using a cylindrical afterbody on the larger body, and correcting for the base pressure variations. Nonresults were obtained for Mach numbers near 1.05.

Schlieren photographs. The Schlieren fields for the delta and swept wings were oriented with respect to the configurations as indicated by the lowest Schlieren photographs and configuration outlines.

In the discussion that follows the basic comparisons and analyses are made for the unswept-wing–cylindrical-body combination. The results for the other combinations indicate the effects of several variations of the wing and body configurations on the phenomena.

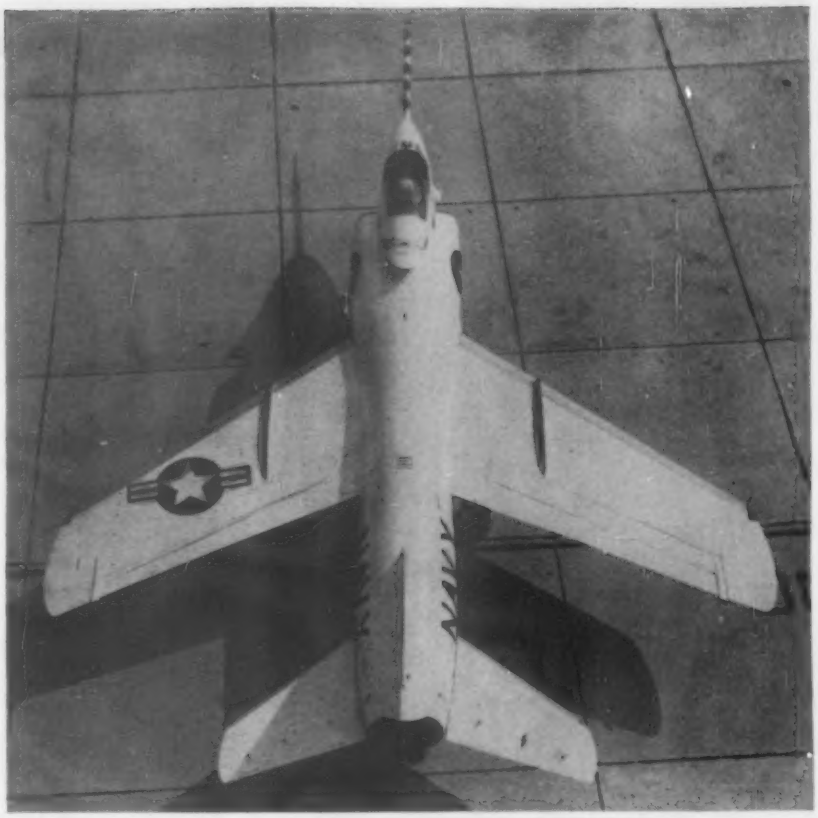
Unswept Wing and Cylindrical Body

Shock phenomena. The wall Mach number distributions and Schlieren photographs indicate that the extensive shock formations produced by the unswept-wing–cylindrical-body combination at the test Mach numbers near the speed of sound are almost exactly the same as those caused by the body of revolution with the same axial distribution of cross-sectional area, except in the local region directly downstream of the wing. In this locality, the shock formation while not as closely similar as at greater distances from the configurations, are at least approximately comparable. (The incompatible shock crossing the downstream, planview Schlieren photograph, at a Mach number of 1.03 is a weak reflection of a disturbance of the configuration from the tunnel wall.) At a Mach number of 1.10 the similarities of the Schlieren photographs for the comparable configuration are less close than at Mach numbers near 1.0.

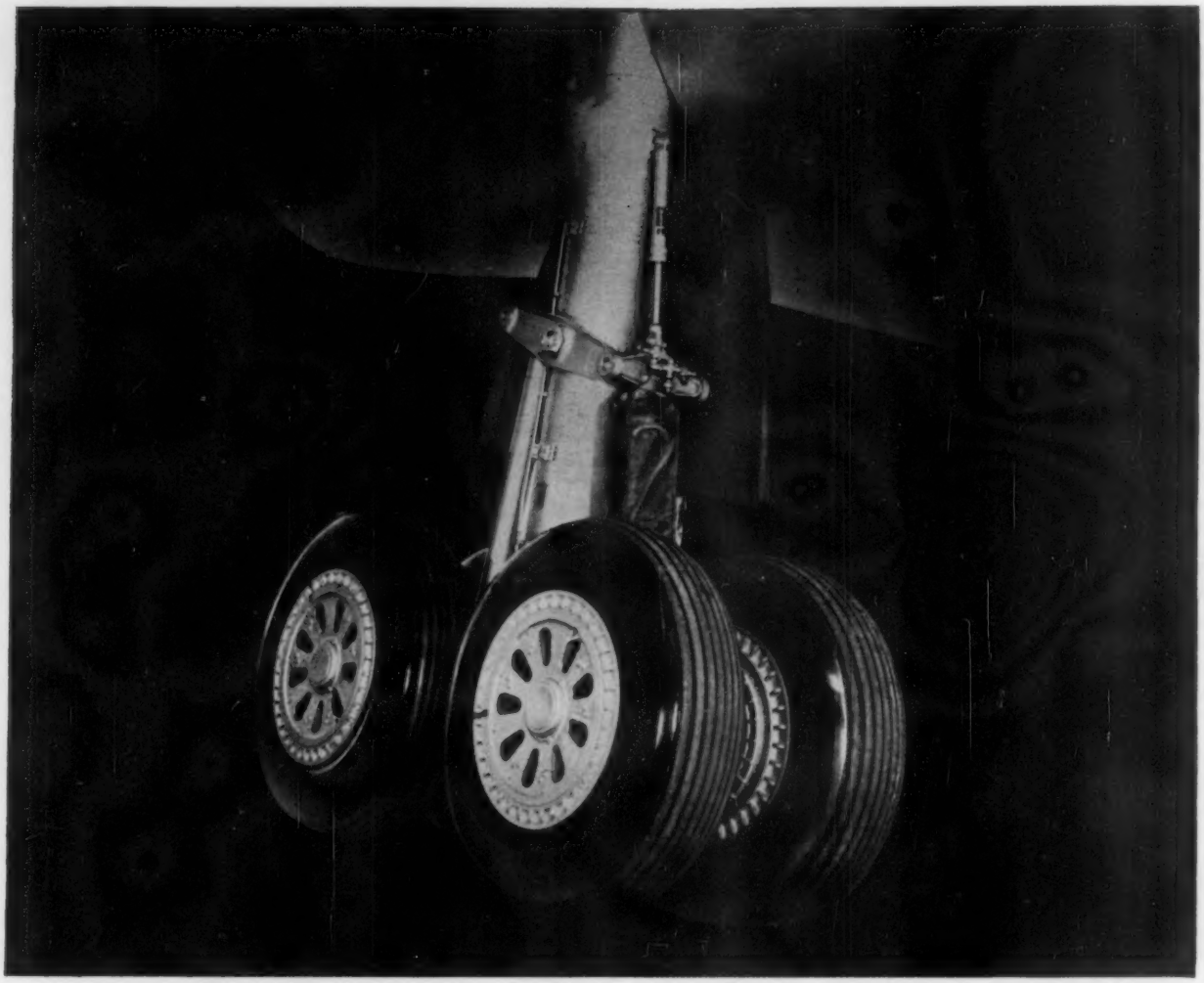
A study of the physical nature of the flow indicates that the similarities of the extensive shock formations produced by the wing-combination and a body of revolution with the same axial distribution cross-sectional area near the speed of sound can logically be attributed primarily to two basic factors: the negligible variations of stream-tube areas with changes in velocity (ref. 8) and the concentration of the effects of a disturbance in a plane nearly normal to the air stream. (These two factors are basically related.) It is apparent that because of the second factor, the streamwise locations of the effects of the disturbances of the wing should be essentially the same as those for the corresponding effects produced by the body of revolution with the same axial distribution of disturbances. Also because of the second factor, the analysis of the lateral similarities of the fields of the comparable configurations may be greatly simplified by considering the flow changes in each normal plane independently.

As a starting point for the analysis of the lateral similarities, consider the flow about the comparable configurations in a given normal plane at a circle, concentric to the axis of symmetry, outside the tip of the wing. As a result of the essential invariance of the stream tubes, the total radial deviations of the fields at this circle are essentially the same as the displacements of the surfaces of the configurations in the same plane. Since the total surface displacements for the two configurations are the same, the total flow deviations at the circle must be essentially equal. However, circumferential variations of these deviations may exist for the wing-body configuration. The essential irrotationality of the flow leads to reductions of these circumferential variations with increase in distance from the configuration.

Because of the invariance of the stream-tube areas, these reductions are relatively rapid. This invariance causes the outer field to be relatively inflexible. As a result, it reacts strongly to the circumferential variations of the radial deviations, producing pronounced circumferential pressure gradients. These gradients cause deviations in the cir-



FUSELAGE of Grumman F11F-1 shows indented fuselage prescribed by area rule.



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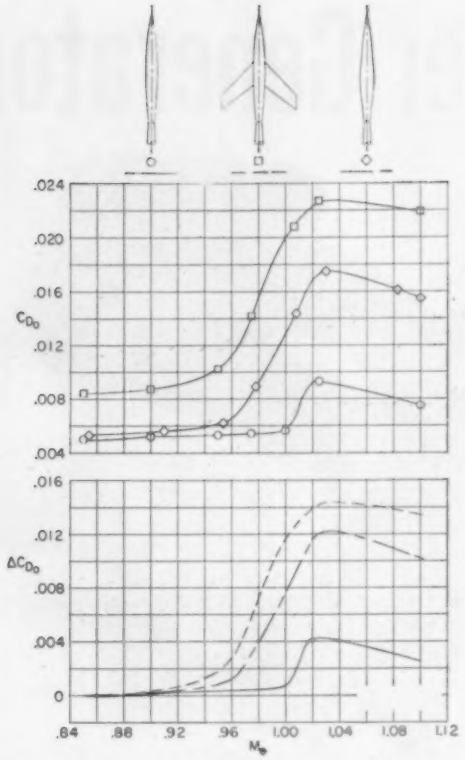

FIGURE 9 Comparisons of the drag rise for the swept-wing and curved-body combination with that for the comparable body of revolution and the curved body alone.

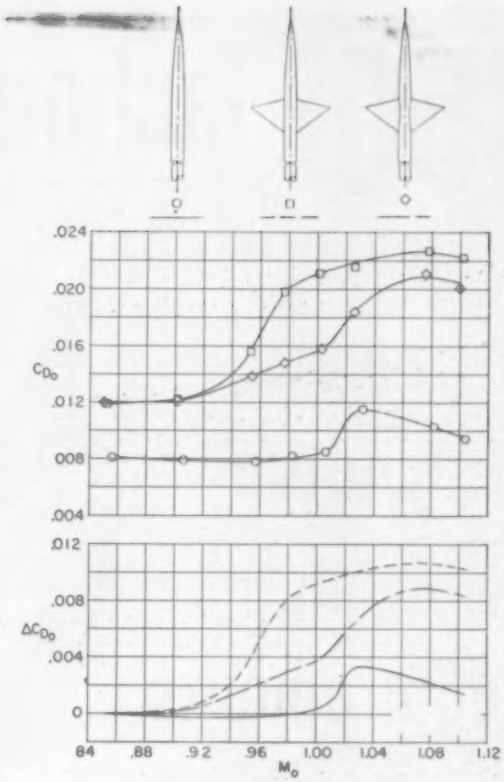

FIGURE 10 (a) Unswept Wing

The effects on transonic drag obtained by indenting the bodies of three wing-body combinations.

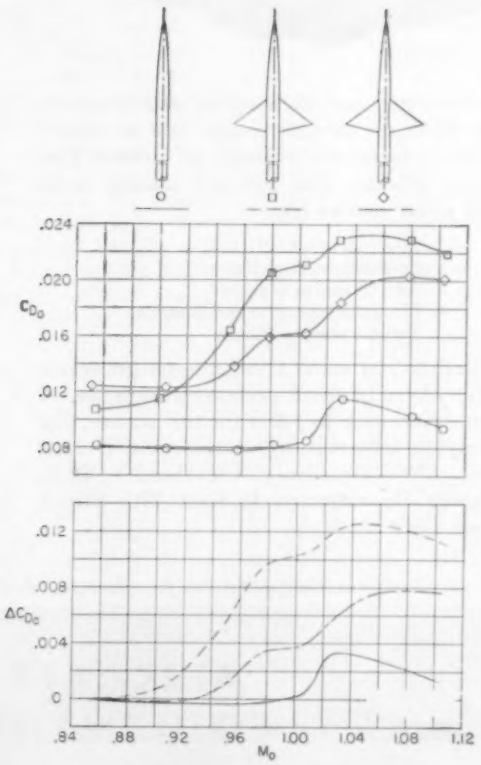

FIGURE 10 - (b) Delta Wing

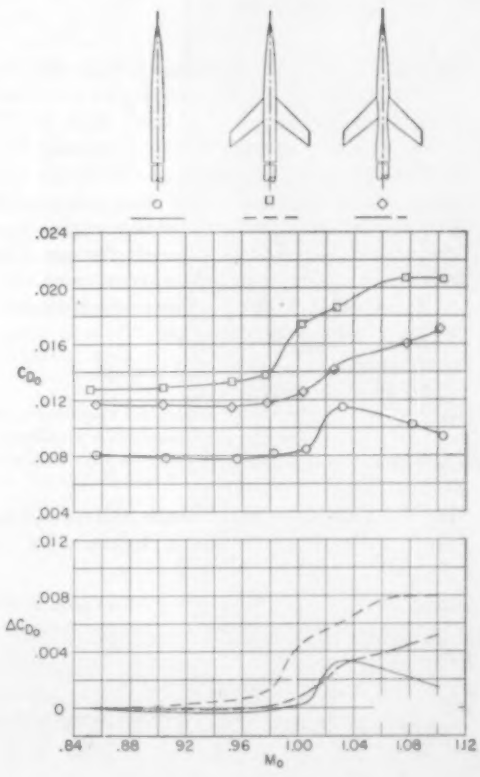

FIGURE 10 - (c) Swept Wing

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TABLE I BASIC BODY ORDINATES

Cylindrical body	
Station	Radius
0	0
.225	.104
.338	.134
.563	.193
1.125	.325
2.250	.542
3.375	.726
4.500	.887
6.750	1.167
9.000	1.391
11.250	1.559
13.500	1.683
15.750	1.770
18.000	1.828
20.250	1.864
22.500	1.875
43.000	1.875

Curved body	
Station	Radius
0	0
.200	.092
.300	.119
.500	.171
1 000	.289
2.000	.482
3.000	.645
4.000	.788
6.000	1.037
8.000	1.236
10.000	1.386
12.000	1.496
14.000	1.573
16.000	1.625
18.000	1.657
20.000	1.667
22.000	1.652
24.000	1.610
26.000	1.537
28.000	1.425
30.000	1.251
32.000	1.010
32.605	0.940

(All dimensions are in inches)

cumferential direction which markedly reduce the variations of the radial deviations. Such effects lead to an essential elimination of the circumferential variations of radial deviations at a relatively short distance from the configuration. Also, any initial circumferential deviations associated with the assymmetry of the wing-body combination are rapidly dissipated with increase in radial distance. As a consequence of the rapid dissipation of both the circumferential deviations and the variations of radial deviations with radial distance, the deviations in a given plane at a short distance from the wing-body configuration are nearly the same as the axially symmetric effects produced by the comparable body of revolution. Such agreements for the various normal planes result in the observed similarities of the strong shock formations for the wing-body combination and the comparable body of revolution at a distance from the configurations.

The strong reactions of the flow in outer regions of the field of the wing-fuselage combination to deviations from axial symmetry, as described above, converge toward the axis of symmentry and reduce the assymmetrical deviations, even in the immediate region of the wing. These reactions force the inner field into at least an approximate similarity to the axially cymmetric field of the body of revolution with the same axial distribution of disturbances.

As the Mach number is increased to supersonic values, the fields of the various disturbances become conical. Also, at these speeds, changes in velocities result in variations of the stream-tube areas. Consequently, the similarities of the shock formations for the wing-body combination and the comparable body of revolution should be progressively lessened as the Mach number is increased beyond the speed of sound.

Drag Characteristics. The close similarity of the shock formations for the wing-body combination and the body of revolution with the same axial variation of cross-sectional area in most regions of the fields suggests that in these regions the energy losses associated with the shocks for the two configurations should be nearly the same. In the locality directly downstream of the wing, the shock losses for the two configurations may differ somewhat; however, the relative effect of such differences should be unimportant. Because of the invariance of the stream-tube areas near a Mach number of 1.0, the fields of flow for these, or any configuration, are relatively extensive. As a result, the greater part of the shock losses for the configurations is due to the large areas of significantly strong shock outside the local region downstream of the wing. Thus, the defferences between the shock losses for the wing-body

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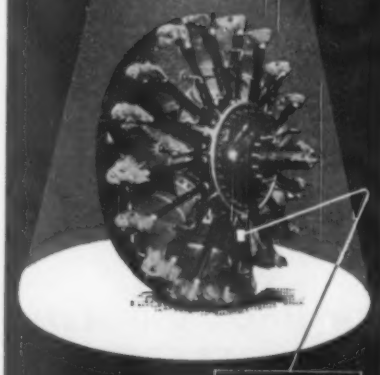

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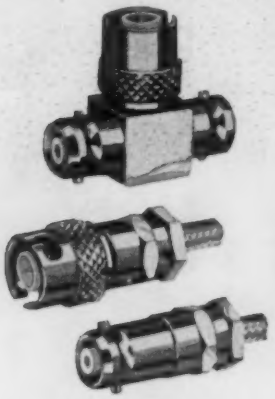

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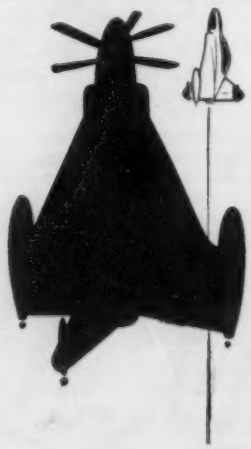


TABLE II ORDINATES OF REVISED BODIES OF REVOLUTION

Comparable to unswept wing on cylindrical body	
Station	Radius
22.500	1.875
23.500	1.875
24.500	1.892
25.000	1.939
25.500	2.012
26.000	2.087
26.500	2.155
27.000	2.182
27.500	2.185
28.000	2.174
28.500	2.145
29.000	2.113
29.500	2.086
30.000	2.054
30.500	2.019
31.000	1.992
31.500	1.968
32.000	1.934
32.500	1.911
33.000	1.894
33.500	1.882
34.000	1.875
43.000	1.875

Comparable to delta wing on cylindrical body	
Station	Radius
22.500	1.875
24.000	1.875
24.500	1.882
25.000	1.894
25.500	1.911
26.000	1.934
26.500	1.968
27.000	1.992
27.500	2.019
28.000	2.054
28.500	2.086
29.000	2.113
29.500	2.145
30.000	2.174
30.500	2.185
31.000	2.182
31.500	2.155
32.000	2.087
32.500	2.012
33.000	1.939
33.500	1.892
34.500	1.875
43.000	1.875

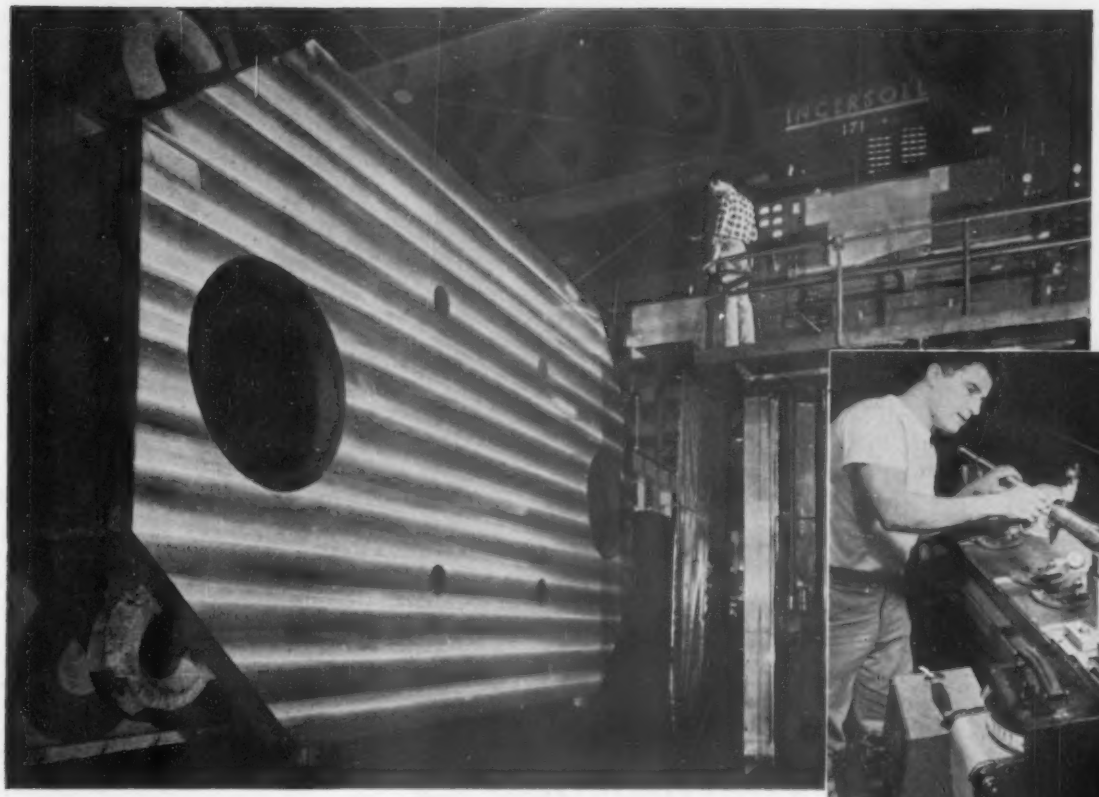
(All dimensions are in inches)

Comparable to swept wing on cylindrical body	
Station	Radius
22.500	1.875
23.125	1.875
24.125	1.907
25.125	1.957
26.125	2.024
27.125	2.080
28.125	2.117
29.125	2.143
30.125	2.135
31.125	2.107
32.125	2.083
33.125	2.071
34.125	2.045
35.125	2.001
36.125	1.946
37.125	1.899
38.125	1.876
38.375	1.875
43.000	1.875

Comparable to swept wing on curved body	
Station	Radius
14.000	1.573
14.300	1.580
14.625	1.595
15.625	1.670
16.625	1.747
17.625	1.836
18.625	1.903
19.625	1.943
20.625	1.966
21.625	1.949
22.625	1.901
23.625	1.857
24.625	1.822
25.625	1.756
26.625	1.664
27.625	1.545
28.625	1.413
29.625	1.292
29.875	1.260
30.000	1.251
32.000	1.010
32.605	0.940

combination and the comparable body in the local region near the wing should result in relatively small differences of the total losses for the two configurations. Also, because of the low thickness ratio and aspect ratio of the wing and the gradual curvature for the comparable body, the shock-induced separation losses for these configurations should be relatively small, although probably not negligible, and any differences of these losses should be small. Therefore, the drag rise for the combination should be approximately the same as that for the comparable body of revolution.

The measured increments of drag coefficient for the unswept wing-body combination are the same as those for the comparable body of revolution within the probable accuracy of the data (Fig. 2). (The absolute drag coefficients for the comparable configurations differ somewhat, primarily



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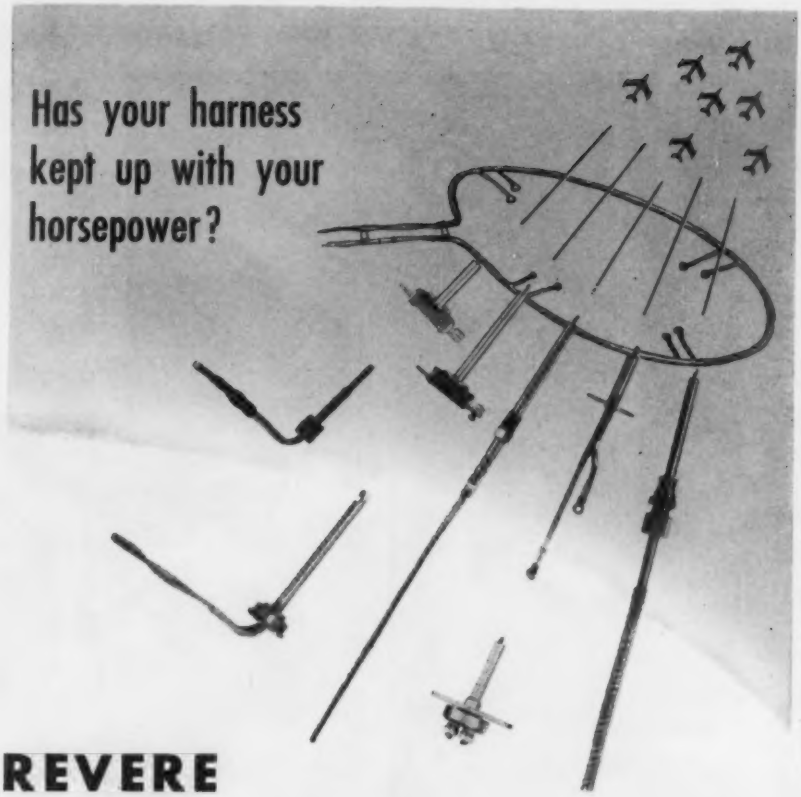

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because of differences in skin friction.)

The exact agreement of the drag-rise increments for the unswept wing-body combination with those for the comparable body of revolution suggests that the secondary separation losses, as well as the primary shock losses, are essentially the same for the two configurations. This apparent agreement can logically be attributed to the fact that the relationships between the shocks and boundry layers for the wing-body combination and the comparable bodies are roughly the same.

The similarity of the drag-rise values for the comparable configurations at a Mach number of 1.10 indicates that the perceptible deviations of the shock formations for the two configurations noted at this Mach number result in insignificant differences of the shock losses.

Delta Wing and Cylindrical Body

Shock phenomena. Wall Mach number distributions indicate that, as for the unswept-wing–body combination, the flow fields for the delta-wing-body combination at a distance from the configuration are generally almost exactly the same as those for the body of revolution with the same axial distribution of cross-sectional area for all test Mach numbers. The Schlieren photographs indicate that in the field above the aft part of the wing, the shocks for the wing-body combination are approximately the same as those for the comparable body. As for the unswept-wing–body combination, the most pronounced deviations of the shock patterns for the comparable configurations probably occur behind the wing.

Drag characteristics. As was found for the unswept-wing–body combination, the measured variation of the drag coefficient with Mach number for the delta-wing–body combination is the same as that for the comparable body of revolution within the probable accuracy of the measurements (Fig. 5).

Swept Wing and Cylindrical Body

Shock phenomena. Wall Mach number distributions indicate that, as was true for the unswept wing-body combination, the flow fields for the swept wing-body combination at a distance from the configuration are almost exactly the same as those for the comparable body of revolution.

The Schlieren photographs indicate that near the speed of sound, the swept wing produces a weak shock at the trailing edge of the wing-body juncture and a strong shock behind the trailing edge of the juncture. At a Mach number of 1.03, an additional weak shock is also present between these two shocks. The losses in the two weak

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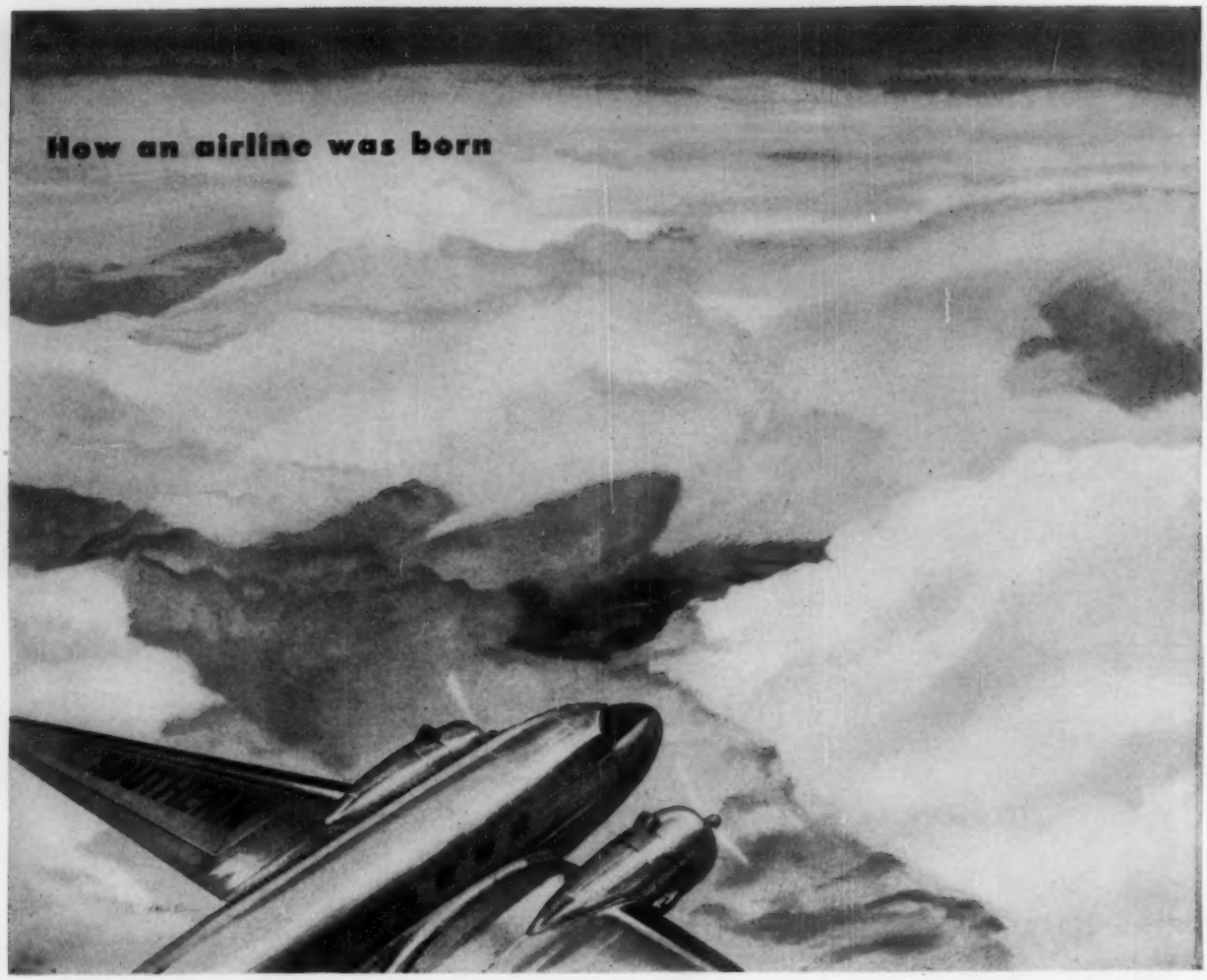

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shocks are insignificant and may be neglected in a comparison of the total shock losses. The side-view Schlieren photographs indicate that the main shock produced by the wing appears to be approximately the same as the shock caused by the comparable body in the region above the combination. However, the shock produced by the wing is generally somewhat rearward of that produced by the body. At a Mach number of 1.00, this shock for the wing is just visible in the Schlieren photograph. Plan-view Schlieren surveys not presented herein indicate that near the wing tip the main shock produced by the wing is somewhat different from that caused by the comparable body, particularly at a Mach number of 1.10. (The shock in this region is similar to that for the same wing on the curved body [Ref. 5]).

Drag characteristics. The drag coefficient increments for the swept-wing and cylindrical-body combination are approximately 0.001 greater than those for the comparable body of revolution at Mach numbers up to approximately 1.02 (Fig. 7). This difference is approximately the same as the total of the possible maximum errors of the drag measurements. However, assuming this discrepancy shown is real, it can logically be attributed to differences in the shock formations and associated boundary-layer separation. At higher Mach numbers, the differences between the drag increments for the comparable configurations increase primarily because of the more pronounced deviations of the shock formations. The greater differences between the drag-rise increments for this swept-wing–body combination and the comparable body of revolution in comparison with those for the unswept wing may be attributed primarily to the greater thickness ratio and smaller taper for the swept wing.

Swept Wing and Curved Body

Shock phenomena. The shock formations as indicated in the Schlieren side-view photograph for the swept-wing–curved-body combination are similar to, but apparently stronger than, those for the swept-wing–cylindrical-body configuration. The differences between the shock formations produced by the swept-wing–curved-body configuration and those for the comparable body of revolution are similar to the differences for the swept-wing–cylindrical-body combination.

Drag characteristics. The combination of the swept wing and curved body results in a severe, adverse drag interference between the wing and body near the speed of sound. The drag-coefficient rise for the swept wing

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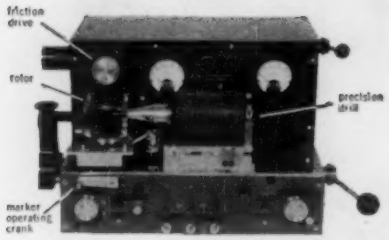

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in combination with this body near the speed of sound is approximately 0.012 compared with a value of 0.004 for the wing in conjunction with the essentially interference-free cylindrical body (Figs. 7 and 9). (These differences in the drag rise values may be due in part to the difference of the maximum body diameter as well as the large variation of the curvature of the afterbody.)

The pronounced drag-rise increments for the wing and curved body configuration are approximately 0.003 greater than those for the comparable body when near the speed of sound (Fig. 9).

The maximum drag rise for the combination, as measured at a Mach number of 1.03, is approximately 15% greater than that for the comparable body of revolution. These differences can be attributed to the same factors which caused the similar but smaller differences for the swept-wing–cylindrical body combination.

Of particular importance is the fact that the relative increase in the drag rise for the swept-wing–curved-body combination compared with that for the wing–cylindrical-body configuration is approximately the same as the relative increase for the comparable bodies of revolution.

Generalization

The results presented indicate that, near the speed of sound, the shock formations and the associated drag-rise characteristics for the various wing and central-body combinations investigated are, to the first order, the same as those for the bodies of revolution with the same axial distributions of cross-sectional area normal to the air stream. These bodies of revolution are simple axial developments of cross-sectional area. Therefore, on the basis of the results presented, it may logically be concluded that, near the speed of sound, the zero-lift drag rise of a thin low-aspect-ratio wing-body combination is primarily dependent on the axial distribution of cross-sectional areas normal to the air stream. It follows that the drag rise for any such configuration is approximately the same as that for any other with the same distribution of cross-sectional areas.

It may be assumed that this concept is also valid for wings alone, wings or wing-body combinations with moderate twist or camber, or yawed configurations; however, no directly comparable experimental results are available to substantiate these conjectures. Linear theory (Ref. 9) and experiments (Ref. 10) have indicated that a similar relation is valid for slender, non-circular bodies as supersonic, as well as at transonic speeds.

Applications of Transonic Drag-Rise Concept

Correlation of drag-rise characteristics. The accuracy of a quantitative correlation of the drag rise of a conventional wing-body combination by using the proposed concept should be lessened by increasing the thickness ratio, aspect ratio, or taper ratio of the wing. The effects of enlarging these variables should become greater as the Mach number is increased beyond the speed of sound. The results presented herein indicate that usual variations of the shape of the body should have little effect on the accuracy of a quantitative correlation. The magnitudes of the section thickness ratios, aspect ratios, and taper ratios for the wings of contemporary transonic and supersonic aircraft generally lie between the values for the unswept and swept wings studies herein. It may be assumed, therefore, that the accuracies of quantitative correlations of the drag-rise increments for these real configurations would be between those for the models investigated.

Because of the lack of knowledge as to the effects of detailed changes in the axial distributions of cross-sectional area on the drag-rise characteristics, quantitative correlations as presented herein are not generally feasible. However, it has been possible to correlate qualitatively all the available, reliable drag-rise results for wings and wing-body combinations (Refs. 1, 2, 11, and 12, for example), by use of the available information for the effects of general changes in body shape on the transonic drag-rise (Refs. 7 and 13, for example). It appears that the concept should be generally useful in comparing the approximate relative effects of various design alterations.

A preliminary analysis of the available information defining the effects of nacelle position on the interference between the nacelle and the wing at transonic speeds (Refs. 4 and 14, for example) indicated that this interference can be correlated qualitatively, at least, on the basis of the concept proposed. However, further specific experimental comparisons are required to define the exact applicability of this concept to the correlation of such interference.

An idea, similar to that proposed herein, was presented in Reference 15 for predicting the critical speeds of wing-body combinations.

Interpretation of variations of drag-rise characteristics. Analyses of the available drag-rise characteristics indicate that variations in wing configurations which result in less rapid rates of development of cross-sectional area, as well as reductions of the relative magnitude of the maximum areas, de-

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crease the drag-rise increments near the speed of sound. For example, the rates of development and maximum value of the cross-sectional areas for the swept wing of the present investigation are less than those for the unswept wing (Table II).

As a result, the drag-rise for the swept wing is less pronounced (Figs. 3 and 7).

Reversing the unswept wing to form the delta wing (Fig. 1) reduced the rate of expansion of cross-sectional area for the forward part of the wing, but increased the rate of contraction of area for the rearward part of the wing (Table II).

These variations resulted in increases of the drag-rise increments (Figs. 3 and 5).

On the basis of this comparison, as well as the results presented in Reference 7, it may be assumed that, near the speed of sound, a given rate of decrease in cross-sectional area generally results in a greater drag-rise than a similar increase.

On the basis of the proposed concept, adverse zero-lift drag interference between wings and bodies, as for hte swept wing–body combination investigated (Fig. 9), can generally be attributed basically to greater rates of development of the cross-sectional areas for the combinations compared with those for the various components (Table II).

These more rapid variations of area generally result in higher induced velocities and considerably stronger shocks in the fields of the combinations. (For example, compare Figs. 6 and 8.) Obviously the interference drags, associated with the increased shock losses, are directly produced by changes in the pressures on the body and wing. (For example, see Ref. 5.) The favorable effects of various changes in body shape on the interference between the wing and body, as shown in references 2 and 12, can be attributed to reductions in the rates of development of the cross-sectional areas.

Reductions of the drag-rise increments of wing-body combinations. On the basis of the concept proposed, it would be expected that indenting the body of a wing-body combination, so that the combination has the same axial distribution of cross-sectional area as the original body alone, would result in a large reduction or elimination of the drag-rise that is associated with the wing.

The cylindrical body of Figure 1, so indented, has been investigated in combination with the unswept, delta, and swept wings such as is shown in Figure 1.

As shown in Figure 10, indenting the body reduced the drag-rise increments associated with the unswept and delta wings by approximately 60 percent near the speed of sound. This alteration eliminated the drag rise associated with the swept wing at Mach numbers up to 1.04 .

At higher Mach numbers, the effects of the indentations gradually decreased. Even for these relatively unconventional configurations, the proposed concept predicts correctly the qualitative effects of design modifications on the drag-rise characteristics near the speed of sound.

The incomplete effects of indenting the bodies with the unswept and delta wings may be attributed in part to the displacement of the stream tubes by the boundary layer, which was neglected in the design of the indentations. For the swept wing, this effect is less important because of the more gradual axial development of the wing. Minor modifications of the indentations of the body to account for this factor should further reduce the drag-rise increments associated with the unswept and delta wings.

The reductions of the effects of these indentations at supersonic Mach numbers are associated with the change in the nature of the flow field at the higher speeds, as described in the discussion of the shock phenomena for the unswept wing.

At lift coefficients up to approximately 0.3, the indentations of the bodies result in drag reductions similar to those shown. While these indentations have not completely eliminated the near-sonic drag-rise increments associated with all the wings investigated, they have at least greatly reduced the increments in every case.

Conclusions

- **The shock phenomena** and drag-rise increments measured for four representative wing and central-body combinations at zero lift near the speed of sound are essentially the same as those for bodies of revolution with the same axial distributions of cross-sectional areas normal to the air stream.
- **On the basis** of these results, it is concluded that, near the speed of sound, the zero-lift drag rise of a thin, low-aspect-ratio wing-body combination is primarily dependent on the axial distribution of the cross-sectional areas normal to the air stream. It follows that the drag rise for any such configuration is approximately the same as that for any other with the same distribution of cross-sectional areas.
- **Indenting the bodies** of three representative wing-body combinations, so that the axial distributions of cross-sectional areas for the combinations were the same as for the original body alone, greatly reduced or eliminated the zero-lift drag-rise increments associated with wings near the speed of sound.

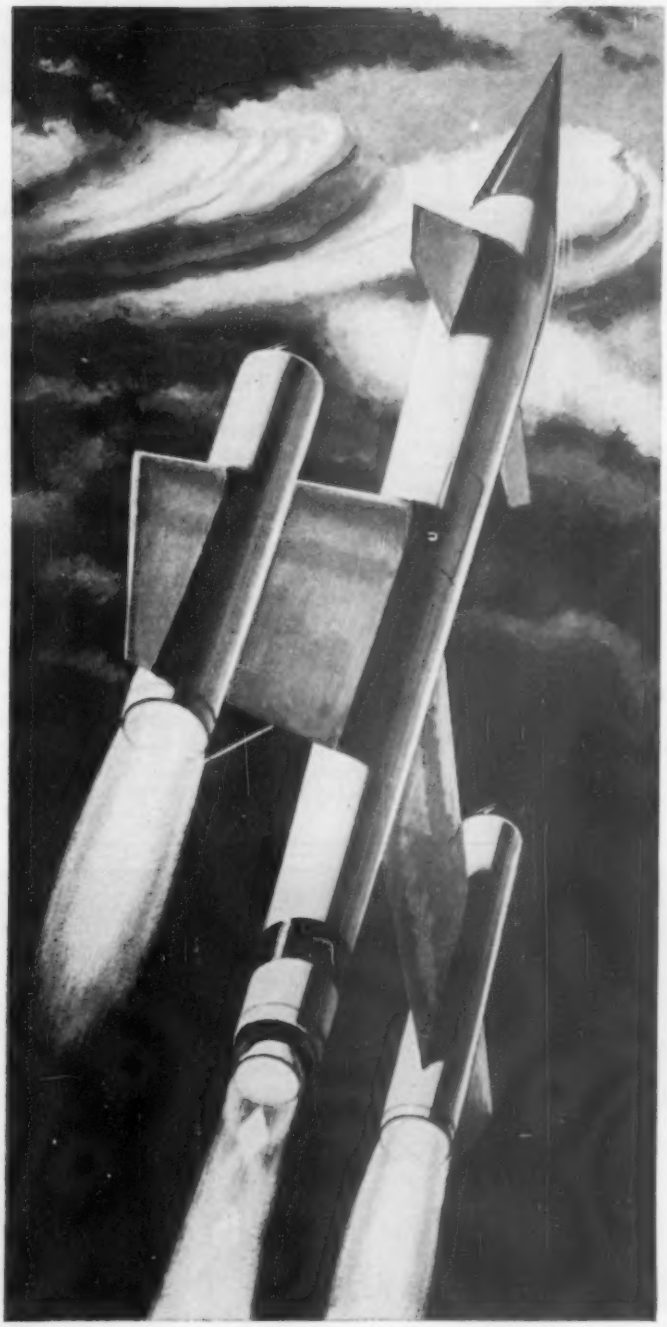

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TABLE III ORDINATES OF INDENTED BODIES

With unswept wing	
Station	Radius
22.500	1.875
24.000	1.875
24.500	1.857
25.000	1.807
25.500	1.720
26.000	1.622
26.500	1.521
27.000	1.476
27.500	1.470
28.000	1.487
28.500	1.533
29.000	1.580
29.500	1.642
30.000	1.664
30.500	1.710
31.000	1.743
31.500	1.773
32.000	1.812
32.500	1.837
33.000	1.856
33.500	1.868
34.000	1.875
43.000	1.875

With delta wing	
Station	Radius
22.500	1.875
24.000	1.875
24.500	1.868
25.000	1.856
25.500	1.837
26.000	1.812
26.500	1.773
27.000	1.743
27.500	1.710
28.000	1.664
28.500	1.642
29.000	1.580
29.500	1.533
30.000	1.487
30.500	1.470
31.000	1.476
31.500	1.521
32.000	1.622
32.500	1.720
33.000	1.807
33.500	1.857
34.000	1.875
43.000	1.875

With swept wing	
Station	Radius
22.500	1.875
23.125	1.875
24.125	1.842
25.125	1.787
26.125	1.710
27.125	1.641
28.125	1.592
29.125	1.560
30.125	1.572
31.125	1.611
32.125	1.640
33.125	1.656
34.125	1.688
35.125	1.740
36.125	1.802
37.125	1.850
38.125	1.874
38.375	1.875
43.000	1.875

(All dimensions are in inches)

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3. Donlan, Charles J., Myers, Boyd C., II, and Mattson, Axel T.: A Comparison of the Aerodynamic Characteristics at Transonic Speeds of Four Wing-Fuselage Configurations as Determined from Different Test Techniques. NACA RM L50HO2, 1950.

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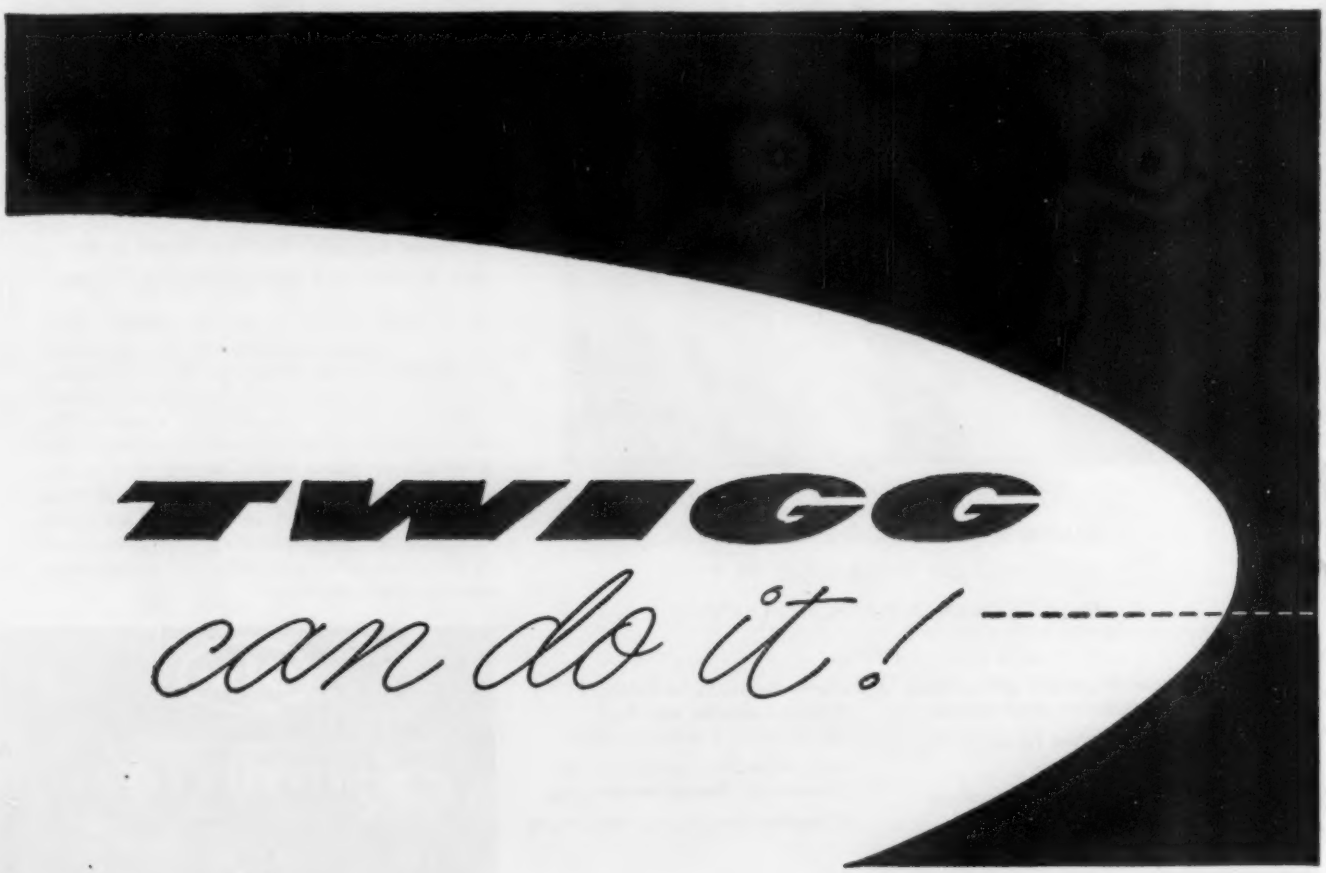
5. Whitcomb, Richard T., and Kelly, Thomas C.: A Study of the Flow over a 45 deg. Sweptback Wing-Fuselage Combination at Transonic Mach Numbers. NACA RM L52D01, 1952.

6. Ritchie, Virgil S., and Pearson, Albin O.: Calibration of the Slotted Test Section of the Langley 8-Foot Transonic Tunnel and Preliminary Experimental Investigation of Boundary-reflected Disturbances. NACA RM L5 1K14, 1952.



7. Thompson, Jim Rogers, and Kurbjun, Max C.: Drag Measurements at Transonic Speeds of Two Bodies of Fineness Ratio 9 with Different Locations of Maximum Body Diameter. NACA RM L8 A28B, 1948.

8. Busemann, Adolf: Application of Transonic Similarity, NACA TN 2687, 1952.

9. Graham, Ernest W.: The Pressure on a Slender Body of Non-Uniform Cross-Sectional Shape in Axial Supersonic Flow. Rep. No. SM-13346-A, Douglas Aircraft Co., Inc., July 20, 1949.

10. Stoney, William E., Jr., and Putland, Leonard W.: Some Effects of Body Cross-Sectional Shape, Including a Sunken-Canopy Design, on Drag as Shown by Rocket-Powered-Model Tests at Mach Numbers from 0.8 to 1.5. NACA RM L52DO7, 1952.

11. Nelson, Warren H., and McDevitt, John B.: The Transonic Characterists of 17 Rectangular, Symmetrical Wing Models of Varying Aspect Ratio and Thickness. NACA RM A5 1A12, 1951.

12. Pepper, William B.: The Effect on Zero-Lift Drag of an Indented Fuselage or a Thickened Wing-Root Modification to a 45 deg. Sweptback Wing-Body Configuration as Determined by Flight Tests at Transonic Speeds. NACA RM L5 1F15, 1951.

13. Thompson, Jim Rogers: Measurements of the Drag and Pressure Distribution on a Body of Revolution Throughout Transition from Subsonic to Supersonic Speeds. NACA RM L9J27, 1950.

14. Biclat, Ralph P., and Harrison, Daniel E.: A Transonic Wind-Tunnel Investigation of the Effects of Nacelle Shape and Position on the Aerodynamic Characteristics of Two 47 deg. Sweptback Wing-Body Configurations. NACA RM L52GG02, 1952.

15. Robinson, Russell G., and Wright, Ray H.: Estimation of Critical Speeds of Airfoils and Streamline Bodies. NACA A ACR, Mar. 1940.

PRODUCTION BRIEFING

▶ **Pratt & Whitney,** Division Niles-Bement-Pond Co., West Hartford, Conn., appointed Southwest Industrial Sales Co. of Dallas, Texas, as its representative in the North Texas area. The territory also will include Stephen and Tillman Counties, Oklahoma, and Shreveport, La.

▶ **The Potter Aeronautical Co.,** Union, N. J., has opened a new office at 22520 Ventura Blvd., Woodland Hills, Calif., under the direction of Richard Franks. Future plans of the company include the construction of a new factory at Malibu, Calif., to service the entire West Coast.

▶ **The George L. Nankervis Co.** purchased a 72,000 sq. ft. manufacturing plant formerly occupied by Nash Div. of the American Motors Corp. Plans are under way for a 12,000 sq. ft. addition to the plant for executive and general offices.

▶ **G. F. Kelk and Co.** has moved to a larger plant at 130 Willowdale Ave., Willowdale, Ontario, Canada.

▶ **General Electric Company's aircraft accessory turbine department** has received a contract from the Wright Aeronautical Division of Curtiss-Wright Corp. to build self-contained turbostarters covering the cartridge type for the J-65 engine.

▶ **Paul C. Peters Co.,** Toledo, Ohio, was awarded a contract for the construction of a plant for L.O.F. Glass Fibers Co. in Defiance, Ohio.

▶ **Avco Advanced Development Division** of Avco Manufacturing Corp. was established with already existing laboratory facilities at Everett, Mass., and design facilities at Stratford, Conn. S. B. Withington, vice president of Avco and president of the Lycoming Division will act as general manager.

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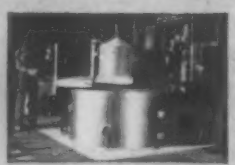

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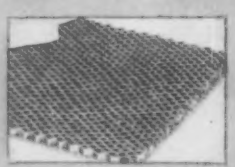

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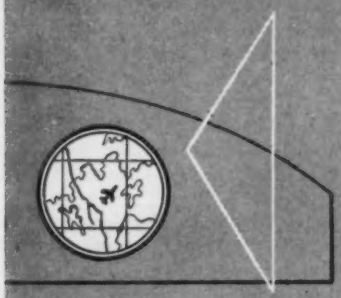

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▶ **Largest single story warehouse** has been completed for the U. S. Air Force in Palmdale, Calif. Located at the Western edge of the Mojave Desert, the structure has over 11 acres of inside storage space plus nearly six acres of paved area for outside storage. The building is to be used for the storage of machine tools and defense equipment. The lessee, Machinery Overhaul Co., Inc., Los Angeles, receives new and used machine tools to be employed for the manufacture of defense products, particularly aircraft parts, under the auspices of the Air Force.

▶ **Arrowhead Rubber Co.**, Long Beach, Calif., has purchased Bellows Division of Airite Products, Inc., and claims to be the first company able to provide all types of duct assemblies for conventional and advanced aircraft design requirements.

▶ **Boice Manufacturing Co.**, Staatsburg, N. Y., producers of precision dial gages and setmasters used in measuring inside and outside dimensions on machine parts, is constructing a plant at Hyde Park, N. Y., to house sales and production personnel and manufacturing facilities.

New Fire Units

New electrically-controlled, two-shot fire extinguishing systems are being installed on production Lockheed Super Constellations. Dibromodifluoromethane and bromotrifluoromethane extinguishing agents replace the heavier carbon dioxide formerly used. Dual systems are installed for right and left nacelles and cabin heaters respectively. Each system has two extinguishing agent containers, assuring two full charges in case of a fire.

BuAer Contracts

The following contract awards of $25,000 and more have been announced recently by the Bureau of Aeronautics, Department of the Navy, Washington 25, D. C.

Goodyear Aircraft Corporation, Akron 15, Ohio, design, develop, fabricate and furnish (3) light duty airship ground handling winches, NO_{as} 55-750-c, SE-74-405-55, 3 ea., $87,433.

Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, N. Y., altimeter, counter pointer NO_{as} 55-631-r PD-42-2934-55, 300 ea., $305,711.

Bausch & Lomb Optical Co., 626 St. Paul Street, Rochester 2, N. Y., design, develop & fabricate prototype aircraft borne infrared absorption hydgrometers, NO_{as} 55-649-d MA-50-4004-55, 2 ea., $45,142.

Bendix Aviation Corp., (Friez Instrument Div.) 1400 Taylor Ave. at Loch Raven Blvd., Baltimore 4, Md., conduct research on & design, develop, fabricate, ground test & furnish (5) experimental models of transosonde for evaluation (5) for service testing, NO_{as} 55-768-c, MA-52-3992-55, 10 ea., $28,464.

Texas Instruments, Inc., 6000 Lemmon Ave., Dallas 9, Texas, radar antennas and spares NO_{as} 55-793-f PD-36-2671-55, 50 ea., $216,010.

Aerojet General Corp., Azusa, Calif., jet assist take-off units NO_{as} 55-829-f MA-30-3674-55, 190 ea., $120,458.

Ruffe, Inc., 7525 Northwest Twenty-Seventh Ave., Miami, Fla., combination bomb rack & rocket launchers, NO_{as} 55-844-r PD-43-1361-56, 600 ea., $467,361.

Czechs Producing Spray/Dust Aircraft

Czechoslovakian Orlican factory at Chcen (East Bohemia) is stated to be producing this Brigadyr agricultural airplane, shown with dual-exit dust dispenser under the cabin. Dust loading is through a port atop the fuselage near the trailing edges of the wings. Design of the high-wing craft is strongly reminiscent of the German Fiesler Storch, which featured considerable area of slots and flaps allowing short takeoffs and slow flying.

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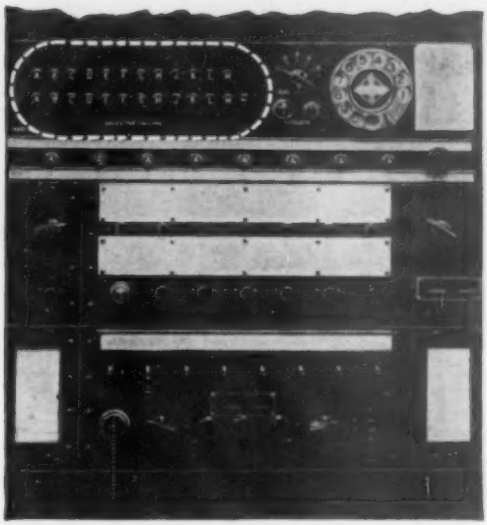

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New York, Los Angeles, San Francisco, Miami, Seattle, San Juan, Honolulu and Okinawa Being Equipped with New Bendix SCL-3 Selective Calling System

To increase their own operating efficiency and provide faster contact service to in-flight aircraft, Arinc is supplementing the old voice calling method with the new, modern Bendix Selective Calling System (Selcal).

Designed by Bendix — built to Arinc specifications — Selcal eliminates the need for continuous use of headphones by replacing voice calling with coded tones over regular HF or VHF communication channels. The tones are received by a decoder in the aircraft. When the assigned tone code is received by a specific aircraft, the decoder activates a visual or aural cockpit signal. The entire procedure takes approximately *two seconds*. And — after the pilot is alerted — communication is carried on in the normal fashion.

Arinc's selection of SELCAL for its complete network of international ground stations is further proof that when you're looking for superior aircraft communications equipment—either ground or airborne—look to Bendix—*the name millions trust.*

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West Coast Sales: 10500 Magnolia Blvd., N. Hollywood, Calif.
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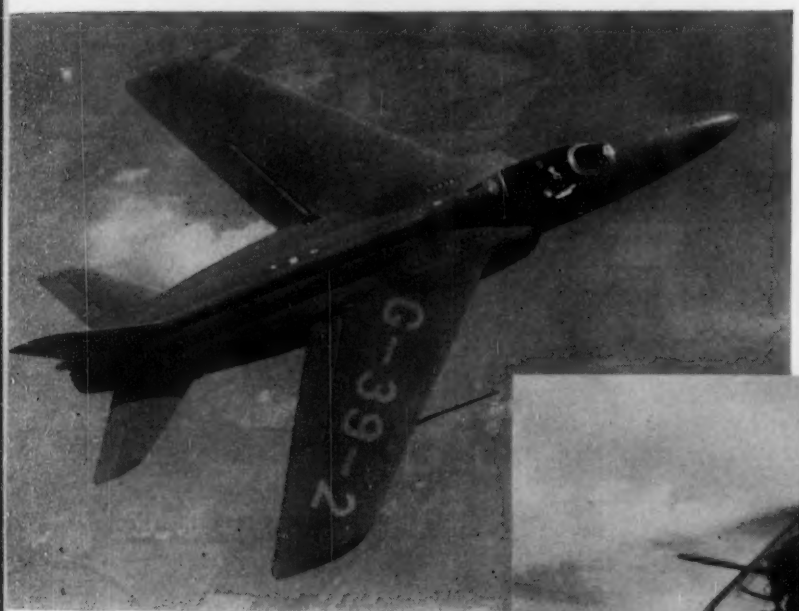
AVRO VULCAN delta-wing bomber's maneuverability was demonstrated at SBAC display by Roland Falk, who rolled the big plane.

British Strength On Display At Farnborough



FOLLAND GNAT lightweight fighter with 4,000-lb.-thrust Bristol Orpheus starred.

FAIREY JET COPTER can be transported on Army three-ton truck. Blackburn-Turbomeca Palouste turbo-generator supplies compressed air to Fairey pressure-jet units at tips of the two-blade rotor.

Every pound of equipment weight saved is worth its weight in gold!

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E. H. HEINEMANN
Chief Engineer, El Segundo Division
Douglas Aircraft Company, Inc.

"It is extremely important that designer, equipment manufacturers, and procuring agencies all have a clear understanding of the relationship between weight-saving and manufacturing costs. While the factor that relates cost to weight varies somewhat for different components and from one manufacturer to another, it has been found in recent years that on the average a pound of weight costs $50 to develop and produce. When this factor is combined with a typical weight growth factor of ten, *the cost of one pound of extra weight amounts to $500 per airplane if performance and strength are to be maintained.* From these figures it can be seen that there is ample justification for the expenditure of engineering time on all phases of a weight-saving program, no matter how small the individual saving may seem."

—E. H. HEINEMANN

at SAE National Aeronautic Meeting, Los Angeles

This growth factor discussed by Mr. Heinemann makes excess weight costly indeed. At $500 per pound, it literally costs its weight in gold. (Gold at $35 per troy ounce is worth $510.30 per avoirdupois pound.)

Vickers Hydraulic Accessories are used extensively in Douglas aircraft because Vickers has long been keenly conscious of the need for lighter, highly efficient and more dependable components. Vickers engineering strives continuously for these goals . . . is a leader in the reduction of weight, and the improvement of performance and reliability of hydraulic equipment. For detailed engineering attention to your problem call a Vickers Application office or write for Bulletin A5200B.

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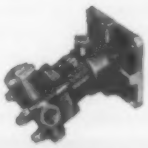

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ENLIST IN THE U. S. AIR FORCE! WIN YOUR WINGS!

Link Delivers New Missile Simulator

The first U. S.-built simulator for the training of guided missile crews was recently delivered to Patrick AFB, Fla., by Link Aviation, Inc.

The device is designed to train crews in guidance and control of the Martin Matador, ground-to-ground tactical missile, by generating radar signals which simulate those echoed from an actual missile.

The trailer-housed Link simulator is used with two other Air Force trailer-mounted units—a radar station and a missile control station. Computers in the Link device generate signals which, when fed to the radar equipment, simulate exactly the flight of a missile on the radar screen, making possible simulated control of the missile.

The Link signal station incorporates a panel with which an instructor can cause various types of failures requiring corrective action on the part of the radar operator or missile controller. The Link unit also includes a deviation recorder which electronically records up to 34 different functions of the radar, radar operator and controller, for crew evaluation purposes.

Link has installed instructor facilities—minus the recorders—in the radar and controller's stations so that an instructor can control missile problems from any of the three stations.

Simulated radar signals from the Link device can be shut down whenever desired and the two Air Force units can instantly switch to tracking and controlling a real missile if necessary. This feature allows crews to continue training in combat areas and rehearse missions which will be actually conducted. It also provides an effective means for checking operational equipment immediately prior to use.

The Link simulator costs slightly more – about $80,000 – than a single missile.

New Executive Plane To Have Delta Wing

Del Mar, Calif.—Work has started here on a prototype delta-wing executive aircraft designed by Harmon Trophy winner J. F. Coleman, pilot of Convair's vertical rising XFY-1.

The triphibian will be able to operate from land or water and can be driven on the highway with its wings folded upwards.

A modified delta of 43-deg. sweepback, the Coleman plane, named the Aeromarine, is expected to have a range of 800-mi. and a top speed of 225 mph. Fuel capacity will be 80 gal. Cruising speed, with up to five passengers, is expected to be 200 mph.

The 2,500-lb. Aeromarine will be powered by a 215-hp. Franklin engine driving a pusher propeller. The engine will be mounted aft of the cabin above the wing.

A retractable hydro-ski mounted under the water-tight hull will be used for water operation.

The wing will fold twice on each side, once near the fuselage and again just inboard of the twin vertical fins. The engine will be geared to the two main wheels of the tricycle gear for ground operation. Front wheel will be fully steerable. Gear will be retractable.

A boundary layer system using air from the engine cooling fan and exhaust augmentation gases will give additional lift on takeoff and landing. Coleman predicts the new aircraft will be able to lift off in only 800-ft. Landing speed will be 57 mph.

A slipstream direction indicator will be mounted on the nose of the Aeromarine to show the attitude of the plane in flight.

The indicator, he says, will be calibrated to show safe attitudes of the plane in relation to airspeed and wind—"the most important consideration in flying any delta wing."

The wingspan will be 25 ft.; overall length, 18 ft. With the wing folded,

Cole Electric Co.

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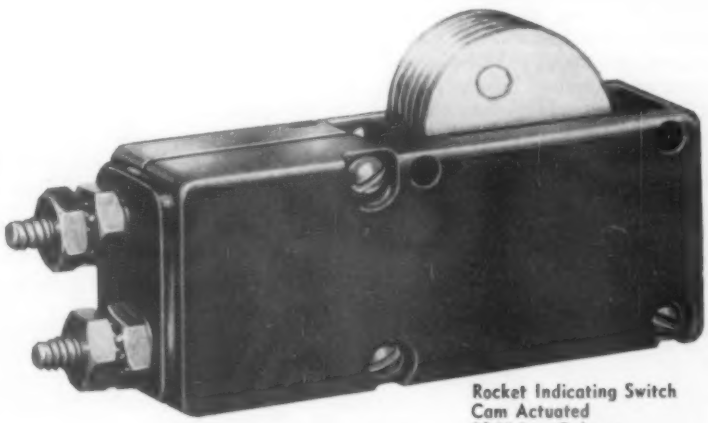

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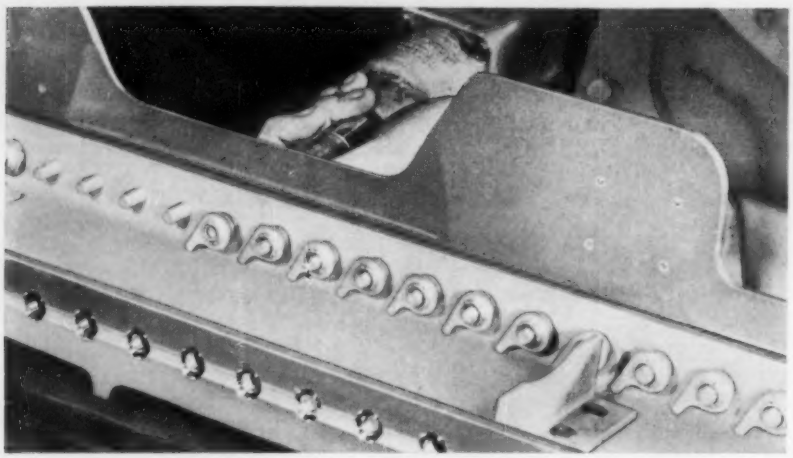
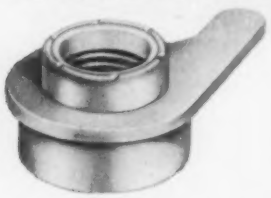


Tightening wing joints without disassembly

Because an entire section of the wing on the F-100 Super Sabre produced by North American Aviation is designed to serve as a fuel tank, fastening the milled skin to main structural members presented several problems. Normal fastener choices would have been either hex nuts or, for blind areas, anchor nuts angled close together and riveted to the beam. Since the entire section had to be sealed to prevent fuel leakage, these rivets would add new sealing complications. Moreover, dozens of rivet holes drilled into a main beam would mean that a stronger and therefore heavier member would be necessary.

Still another problem was presented by the nonfuel carrying sections of the wing and particularly the main attach joint for the leading edge, because field service requirements can make it necessary to re-tighten bolts. This would be impossible with ordinary hex nuts because the joints are inaccessible for wrenching—unless the entire leading edge section is removed.

On the F-100 these problems are solved by using ESNA's self-wrenching nut, pictured below. It has a self-wrenching lug, located high on the nut body to clear the fillet radius of the adjoining flange or structure, which prevents the nut from rotating during wrenching of the bolt. Shown installed along the wing's leading edge (above), ESNA's self-wrenching nut makes retorquing a matter of minutes, instead of hours. Additional sealing operations and riveting of anchor nuts to major structural members are avoided—while original assembly is faster and easier.



Axial tensile strength is equivalent to 160,000 psi at the minimum pitch diameter of the bolt thread. A complete line of these fasteners is available in sizes -048 through -098.

MAIL COUPON FOR DESIGN INFORMATION

Dept. N86-925, Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastener information:

☐ Details on ESNA self-wrenching nut

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name_____ Title_____

Firm_____

Street_____

City_____ Zone_____ State_____

the width will be less than 6 ft.

"The primary consideration in the Aeromarine was to design a good airplane that could operate off land or water," Coleman says. "Adapting the plane to operation as a medium-performance car was secondary. We were satisfied with a 50-mph. top speed on land because anything more might have interfered with the Aeromarine's performance as a plane."

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

WRIGHT-PATTERSON AIR FORCE BASE, OHIO.

Springfield Elevator Co., 120 West North Street, Springfield, Ohio, furnishing inspection, lubrication, maintneance, minor repairs, and adjustment of certain lifts, hoists, cranes, monorails, and other related equipment (also major repairs & adjustments to same equipment) under the jurisdiction of WADC, Wright-Patterson Air Force Base, Ohio, (contract No. AF 33 (601)-202, job, not to exceed $60,000.

Republic Aviation Corp., 447 Broadway, Hicksville, L. I., N. Y., bombing training device, type MN-1., (contract No. AF 33 (601)1970), 2 ea., $29,327.

Hanagan Construction Co., Bloomfield Ave., Urbana, Ohio, installation of Tacan facility OBD AN/URN-3 at area "C" Wright-Patterson Air Force Base, Ohio, (IFB 33-601-55-233), job, $29,100.

Tri-State Protective Co., 801 Cleveland Ave., Cincinnati, Ohio, installation of Fire Alarm System, "Family Quarters", area "C" Wright-Patterson Air Force Base, Ohio, (IFB 33-601-55-234), job, $30,389.

TINKER AIR FORCE BASE, OKLAHOMA CITY, OKLA.

Midwest Construction Co., 1025 N. W. 9th St., Oklahoma City, Okla., modification of building Nr 230 for SAC Hangar, shops and administrative space, Tinker AFB, Oklahoma City, Okla., project OC-149-55, (IFB 34-601-55-466), job, $49,797.

Land-Air, Inc., 201 N. Wells St., Chicago 6, Ill., kit, fabrication, 1AFF-TO-1B-50(R)-201, 13 ea., kit, 1AFF-TO-1B-50-(R)-203, 3 ea., kit, 1AFF-TO-1B-50-(R)-202, 3 ea., (IFB 449-01F-OC-696387, OC-696388 and OC-696389), $53,769.

AIR RESEARCH & DEVELOPMENT COMMAND, BALTIMORE, MD.

Massachusetts General Hospital, Boston, Mass., research in "Nervous Regulation of Respiration in Man", (AF 18(600)-1476), job, $46,905.

The Trustees of Princeton University, Princeton, N. J., research-studies in algebraic techniques (AF 18(600)-1494), job, $51,000.

ROBINS AIR FORCE BASE, GA.

Indianapolis Machinery & Supply Co., (Agent, James Archdale & Co., Ltd., Birmingham, England) 1959 S. Meridian Street, Indianapolis, Ind., radial drill press, size A3 in accordance with Fed. Spec. 00-D-696, 45 ea., (RFP-1291), $206,775.

Cox & Stevens Electronic Scales Div. Revere Corp., Wallingford, Conn., aircraft weighing kits, electric, 400,000 lb. cap., 8 ea., (RFP-1323), $29,398.

Dashew Business Machines, Inc., 5886 Smiley Drive, Culver City, Calif., plates, identification, shipping & storage, aluminum alloy, 570,000 ea., (IFB-LP-64), $32,862.

Mac's Service, 3108 Old Shell Road, Mobile, Ala., overhaul & repair various items of powered hand tools, lubricators, etc., job, $44,732.

PINECASTLE AIR FORCE BASE, ORLANDO, FLA.

Electric Construction Co., Inc., 600 Cen-

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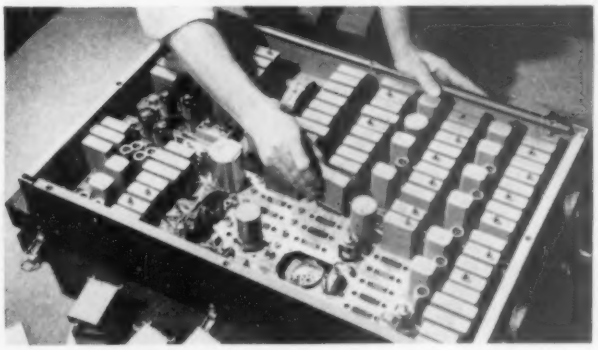
Dick Hale serves the New York and New England areas. Through Dick*, or one of his counterparts in your area, you can get all the facts on bomber defensive systems . . . part of the Air Arm systems family. Right now, Dick Hale wants to tell you why these Westinghouse tail turret systems can be counted on to score a . . .

Bull's-Eye!

Here are some of the important FACTS behind these systems:



MAGAMPS, potted units and sealed components are used extensively in Westinghouse bomber defense systems. They stand up under rugged conditions, give *extra* reliability to system operation.

Air Arm is turning out production systems in quantity and has been delivering on schedule from its large modern plant ideally located next to Friendship International Airport in Baltimore, Md.

J-91026-A

**Dick Hale can be contacted at 40 Wall St., New York 5, N.Y., Phone: Whitehall 3-4321.*

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TOMORROW'S AIRCRAFT: *One step closer*

Bull's-eye!

In bomber defensive action Westinghouse tail turret systems pay off in bull's-eyes . . . the only pay-off that is respected.

This defense of high-performance aircraft, like the Douglas A3D Skywarrior, against tail attackers requires instantaneous, pin-point accuracy *plus* reliability in every component of the complex radar and fire control equipment.

Air Arm radar uses high-speed sequential lobing and high-performance servos, resulting in excellent tracking accuracy. Computer reliability is enhanced by the use of MAGAMP* magnetic amplifiers and potted units . . . all adding up to more than sufficient capability to down the fastest moving enemy aircraft.

Since 1946, Westinghouse has been developing, designing, testing, and *building* bomber defense systems, the latest features of which are still classified. Current production systems are being turned out in quantity for the armed forces, and on-schedule deliveries have been made for more than a year.

At the same time, parallel engineering development is constantly advancing the state of the art, working hand in hand with aircraft manufacturers and the military — to help you bring Tomorrow's Aircraft . . . One Step Closer. Westinghouse Electric Corp., Air Arm Division, Friendship International Airport, Baltimore 27, Md.

*Trade-Mark

J-91026-B

On the Air Arm firing range, Armorer C. E. Brust, Jr., Test Supervisor Norman Brown, and Electrical Tester W. C. Scheele check over a typical burst pattern—evidence of accuracy backing up the fine reputation these systems have gained.

THE AIR ARM SYSTEMS FAMILY

Fighter Armament	**Bomber Defense**	**Flight Control**
Missile Guidance	**Special Purpose**	**Systems Components**

YOU CAN BE **SURE**...IF IT'S

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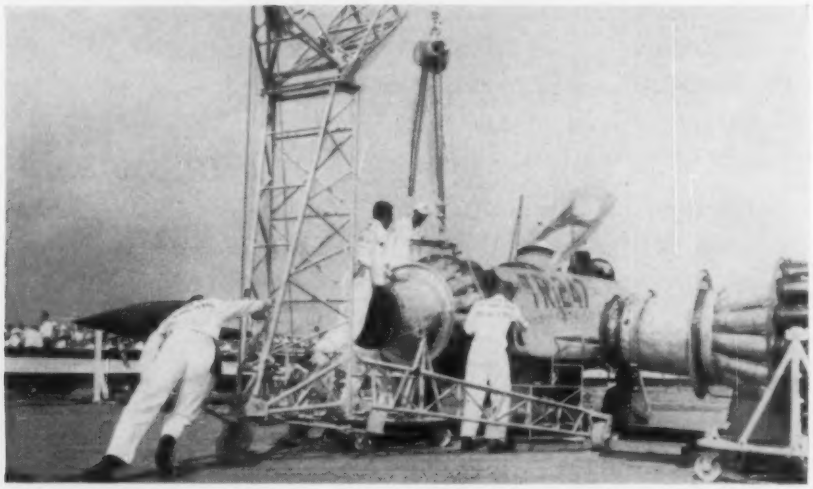
Engine Crews Race for Allison Trophy

UNBUTTONING AFT FUSELAGE of Lockheed T-33A, mechanics start to replace J33.



CRANE MOVES IN to pull Allison turbojet off. Replacement engine stands by at right.

ENGINE IN PLACE, crew completes hookup. Engine had to be started and operated at idle.

TROPHY GOES TO crew from Webb AFB, Big Spring, Tex. Time: 10 min. 32 sec.

tral Ave., Orlando, Fla., construction of instrument landing approach system. (IFB-08-617-55-29), job, $107,748.

WILKINS AF STATION, SHELBY, OHIO.

Regent Jack Mfg. Co., Inc., 11905 Regentview Ave., Downey, Calif., item 1-8200-368058 Jack HaHnd Hyd 10 ton cap. folding tripod, type B-6, AF dwg. 50J25178, iaw spec. MIL-J-7400A dated 16 April 1953, 130 ea., $51,937, item 2-spare parts for item 1, not to exceed 15 percent of the total cost of item 1, one lot, $7,790.64, item 3-one-set maintenance data iaw table III, part C, revisions, $840, (total $60,568). PR WL-405060 and 570346.

McCLELLAN AIR FORCE BASE, McCLELLAN, CALIF.

North American Aviation, Inc., P. O. Box 95, Fresno, Calif., processing into storage, maintenance in storage, removal from storage, accomplishment of transfer inspection and various modifications on fifty-nine (59) F-86D type aircraft., (P/R 338), 59 ea., $30,000.

Lockheed Aircraft Corporation, P. O. Box 551, Burbank, Calif., modification of RC-121D aircraft, (P/R 337), 9 ea., $533,128.

AVIATION SUPPLY OFFICE, PHILADELPHIA 11, Pa.

Skyline Clothing Corp., 424 Central Ave., Peekskill, N. Y., suit, (383/255-42/55), 4990 ea., $66,617.

William Armstrong Smith Co., 109 E. Forest Ave., East Point, Ga., paint, (IFB-383-958-55), 4598 gal, $35,067.

Reliance Chemical Co., Lee Terminal Standiford Field, Louisville 13, Ky., enamel, (IFB-383-991-55), 16,000 gals, $26,103.

Tektronix, Inc., 7709 Ogontz Ave., Philadelphia 38, Pa., electronic test equipment, (PREN 11-3935/55), various, $28,466.

General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass., electronic test equipment, (PREN 11-3924/55), various, $34,813.

Scintilla Div., Bendix Aviation Corp., Sidney, N. Y., services, (383/2320-236/55, 383/2221-201/55, 383/2117-161/50), various, $27,208.

General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass., electronic test equipment, (PREN 11-3935/55), various, $35,037.

OKLAHOMA CITY AIR MATERIAL AREA.

Lear-Romec Div., Lear, Inc., Abbe Road, Elyria, Ohio, pump assy., dry air, (IFB OC-645634 and OC-586117), 4 items, $37,142.

Allison Division, General Motors Corp., Indianapolis, Ind., modification of J33-A-16/16A exhaust unit assemblies, 450 ea., $194,346.

Thompson Products, Inc., 23555 Euclid Ave., Cleveland 17, Ohio, gears, matched set (IFB OC-586115), 54 items, $66,645.

Niles-Bement-Pond Co., Chandler-Evans Division, Charter Oak Blvd., West Hartford Conn., reproducible copy and negatives for handbook of overhaul instruction for afterburner fuel regulator,, model AR-7, (IFB OC-418242), 10 items, $27,686.

Parker Aircraft Co., 5827 W. Century Blvd., Los Angeles 45, Calif., valve assy. check model 527-4D (IFB OC-455597), 2 items, $43,551.

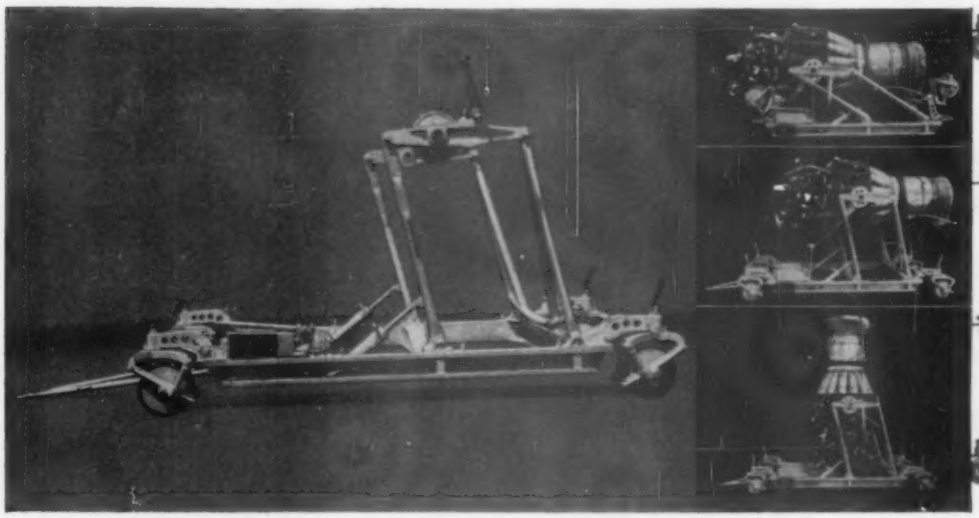
GENTILE AIR FORCE STATION, DAYTON, OHIO.

The Sperry Corp., The Sperry Gyroscope Company Division, Marcus Avenue & Lakeville Road, Great Neck, N. Y., radar test sets, AN/UPM 12 in accordance with MIL-R-8724, 53 ea., maintenance spare parts, maintenance data, Air Force drawing and data list requirements, RFP 33-604-55-2817, $67,196.

Tung-Sol Electric Inc., 95 Eighth Ave., Newark 4, N. J., tube, electron JAN 5725/6AS6W/6187, 45,450 ea., tube electron JAN 6098/6AR6WA, 2,800 ea., tube electron JAN type No 5751W, 2,500 ea., tube electron triode JAN 6188/6SU7WGT, 2,000 ea., RFP 33-604-55-3197, $216,250.

C.B.S. Hytron Div., of Columbia Broadcasting System, Inc., 100 Endicott Street, Danvers, Mass., tube, electron receiving

Ground handling equipment mass produced on precision basis



The economical handling and transportation of large bulky items, such as engines, wings, and tail sections, to and from field repair bases, have necessitated the use of tactical ground handling or ground support equipment.

Loud's production "know how" and complete facilities have made it possible to mass produce this type of equipment with complete interchangeability of all parts through the use of well designed and precision built tooling.

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CEC's DataTape offers an ideal solution to this dilemma. Compact, rugged DataTape airborne units record vast quantities of flight-performance data on multichannel tape. After the test flight, stationary ground playback equipment faithfully reproduces the electrical signals originally produced by the airborne transducers. These accurately simulated flight-test signals may then be automatically processed by high-speed digitizing and computing systems, such as CEC's MilliSADIC and ElectroData's digital computer—a completely compatible team for solving the bottleneck of flight-test data reduction. *Write today for Bulletin CEC 1561-X8.*

Here are two of the *airborne* units of the DataTape group, which also includes signal modulators, range-time generators, automatic calibrators, and complete ground playback equipment . . . *all designed specifically for the flight-test engineer.*

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Data Channels . . . 12 or 24 standard, plus 1 flutter-control track and 1 time or voice track per 12 data channels.

Tape Speeds . . . 10, 20 and 40 in/sec; or 7½, 15 and 30 in/sec.

Recording Time . . . 43 minutes at 10 in/sec; 57 minutes at 7½ in/sec.

Flutter . . . less than 0.2% peak to peak (0.08% rms) over 5 to 300 cps band @ 10 in/sec. Mechanical flutter compensation on playback reduces this figure to 0.1% peak to peak (0.04% rms) in 0 to 20 cps range; electronic system compensates for flutter at higher frequencies.

Power . . . 115 volts, single-phase, 50/60/400 cps; 275 watts.

Size . . . 7 x 22 x 11¾"; 60 pounds.

Controls, indicators . . . all on top plate. Warning lamps indicate data loss from mechanical or electronic failure.

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Channels . . . 14 or 28, including flutter-control, range-time and voice-recording tracks.

Frequency response . . . without modulators, flat ±1.6 db 300 to 18,000 cps @ 10 in/sec and 300 to 36,000 cps @ 20 in/sec; flat ±2.3 db 300 to 60,000 cps @ 40 in/sec.

Signal Input . . . 0.50 volts full scale; channel input impedance to attenuator 100,000 ohms.

Power . . . 115 volts, single-phase, 50/60/400 cps; 225 watts.

Size . . . 5⅞ x 22 x 11¾"; 35 pounds.

*Unit contains own data-channel amplifiers, power supply, bias and flutter-control oscillators, and microphone amplifier.

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diode pentode, type 5726/6AL5W/6097, 50,500 ea., tube electron JAN type 5814WA receiving triode, 47,000 ea., RFP 33-604-55-3187, $111,210.

Lewt Mfg. Corp., 60 Broadway, Brooklyn 11, N. Y., signal generators, TS-452C/U, 799 ea., maintenance spare parts, revision handbook data requirements, engineering data, RFP 33-604-55-3216, $438,463.

America Phenolic Corp., 1830 South 54th Avenue, Chicago 50, Ill., modification of test bench groups, air portable, 8 ea., PR:GE-553753, $98,000.

Maguire Industries, Inc., Thordarson-Meissner Mfg. Div., Seventh and Bellmont, Mt. Carmel, Ill., junction box, J-299 ()/ARN-14 in accordance with spec MIL-J-8093 (USAF), 105 ea., maintenance spare parts, maintenance data (basic), engineering data, RFP 55-604-55-3295, $61,541.

MIDDLETOWN AIR MATERIAL AREA, Pa.

Blue Anchor Overall Co., Inc., 1826 E. Somerset St. Philadelphia 34, Pa., sling, aerial delivery, (IFB 36-600-55-5250(Q), 16870 ea., $179,665.

Polan Industries, Inc., Huntington, W. Va., adapter, release assy., binder assy., cover, fastener, link assy., for kit, aerial del., (IFB 36-600--55-5248), 20,378 ea., $47,173.

Jayval Mfg Co., 301 California Bldg., 710 Seventeenth St., Denver 2, Colo., riser,-suspension, strap-shear, and shock pad, (IFB 36-600-55-5248(Q), 12,098 ea., $89,784.

Reliance Mfg. Co. 350 Fifth Ave., New York 1, N. Y., pilot chutes, (IFB 36-600-55-5231), 6,666 ea., $36,663.

M. Steinthal & Co., Inc., 222 Fourth Ave., New York 3, N. Y., risers bag and bridal, (IFB 36-600-55-5231), 26,664 ea., $175,849.

Alamo Mfg. Co., Inc., 1407 Broadway New York 18, N. Y., canopy, (IFB 36-600-55-5231), 6666 ea., $365,363.

Irving Air Chute Co., Inc., 1315 Versailles Rd., Lexington, Ky., box, cargo aerial delivery, (IFB 36-600-55-5249-Q), 8537 ea., $277,879.

Blue Anchor Overall Co. 1826 E. Somerset St., 34, Pa., box, cargo, aerial delivery, (IFB 36-600-555249-Q), 8,536 ea., $277,846.

Stein Bros. Mfg. Co., 1401 W. Jackson Blvd., Chicago 7, Ill., life preserver, (IFB 36-600-55-5278(Q), 25,640 ea., $507,672.

McPhillips & Co., Inc., 239 Bernard St., Trenton 8, N. J., kit, (IFB 36-600-55-5264-(Q), 75,000 ea., $116,250.

Wright Aeronautical Div., Curtiss-Wright Corp., Wood-Ridge, N. J., wheel welding & machining assy., (IFB PR 598065), 164 ea., $68,877.

Mills Mfg. Corp., P. O. Box 8145, Asheville, N. C., parachute, cargo, (IFB 36-600-55-5252(Q), 13,500 ea., $997,650.

Sigmund Eisner Co., 2-39 Bridge Ave., Red Bank, N. J., parachute, cargo, (IFB 36-600-55-5252(Q), 13,500 ea., $997,650.

SACRAMENTO AIR MATERIAL AREA Calif.

Andrew Corp., 363 E. 75th St., Chicago 19, Ill., antenna, transformer and cable, IFB's P/R 43213, 43216, 43217, 43220 and 43225), various types and quantities, $70,132.

A. Teichert & Son, Inc., 1931 Stockton Blvd., Sacramento, Calif., demolition and removal of contract and replacement, (IFB 250), job, $32,768.

Colorado Fuel & Iron Corp., Pacific Coast Div., 1080-19th Ave., Oakland 6, Calif., wire, cloth, (IFB 211), 166,000 sq. ft., $92,236.

National Wood Treating Corp., 1404 Franklin St., Oakland, Calif., pole-line const., wood, (IFB P/R 41042 and 43228), 684 ea. $62,025.

Service Station Engr. Co., Inc., 523 P. St. Fresno, Calif., install truck and railroad scale, (IFB 233), $27,230.

General Electric Supply Co., 1131 S. St., Sacramento, Calif., motor, (IFB P/R 32323), 216 ea., $52,574.

Ellis Co., 1923 Stockton Blvd., Sacramento, Calif., repair roof on docks 1, 2 and 3, also shop section of Bldg. 51-A (IFB) 209), job, $49,157.

Permacel Tape Corp., New Brunswick, N. J., tape, adhesive, (IFB 194), 30,000 rls., $65,520.

Howard S. Markwart, 4801-24th St. Rd., Sacramento, Calif., install cooling towers in

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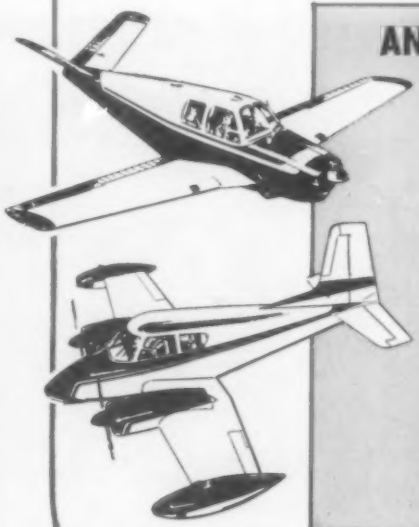

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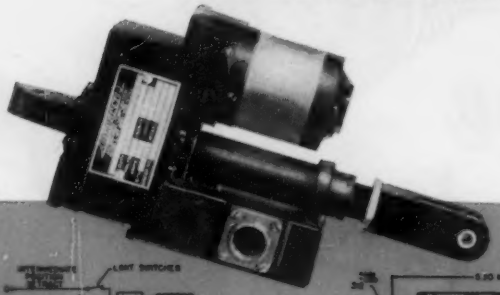
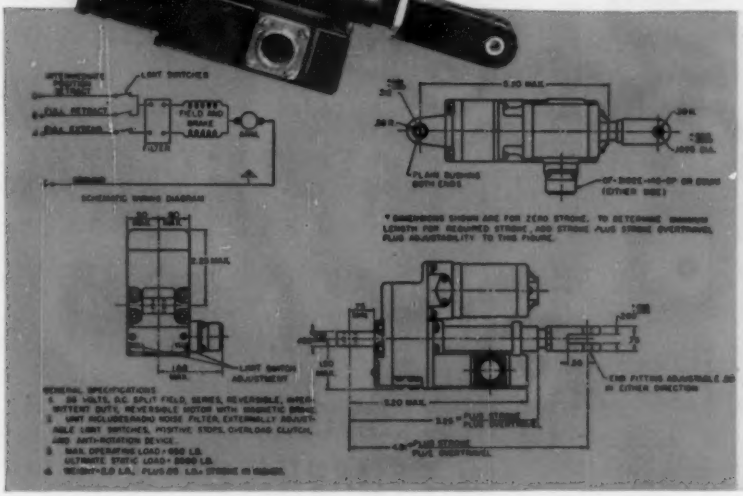
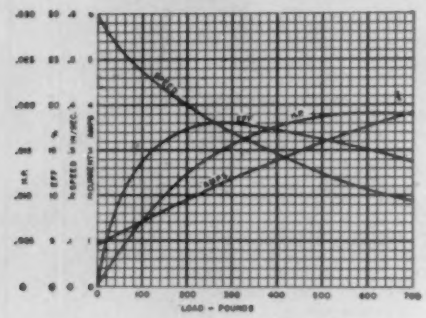


R-580

650 lb. max. op. load
with intermediate
position switch
wt. 2.0 lbs.

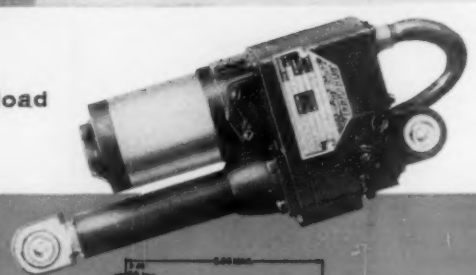


AVAILABLE FOR EITHER 26 V D.C.
OR 400 CYCLES A.C.

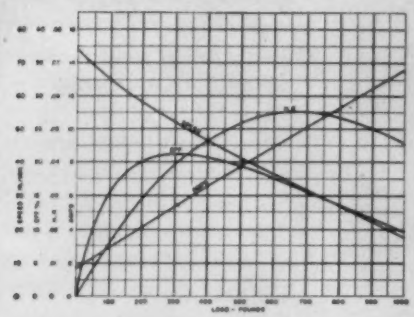


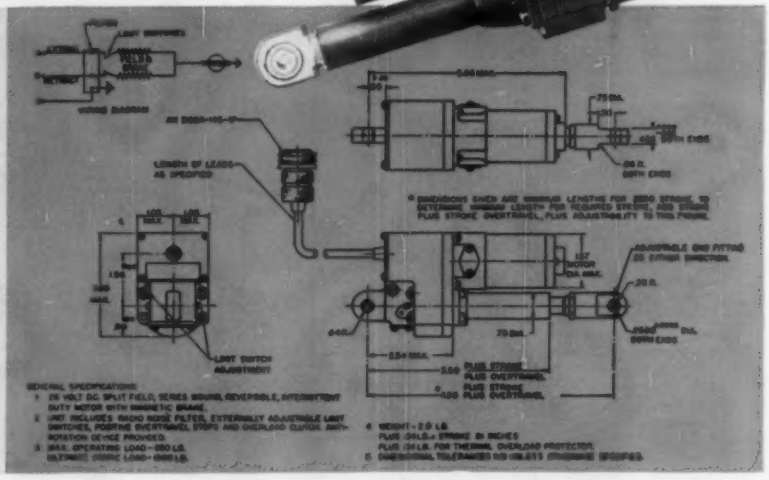
R-584

650 lb. max. op. load
wt. 2.0 lbs.



AVAILABLE FOR EITHER 26 V D.C.
OR 400 CYCLES A.C.





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bldg. 331, (IFB P/R no. 39708 & 39709), $27,033.

Acme Steel Products Div., Acme Steel Co., 2840 Archer Ave., Chicago 8, Ill., strapping, steel, (IFB 195), 200,000 coil, $28,456.

Lockheed Aircraft Corp., P. O. Box 551, Burbank, Calif., reproduction copy of pages nec. to accomplish printing of Tech Orders AF 04(606)-4574, (IFB P/R's 8443 & 8444), $33,726.

Johns Manville Sales Corp., 116 New Montgomery St., San Francisco, Calif., blanket assy., (IFB P/R 5816 & 5817), 2,642 ea., $61,446.

Consolidated Diesel Electric Corp., Ludlow and Canal St., Stamford, Conn., kits, compressor, and installation of kits, (IFB P/R 1941), 550 ea., $8,150,645.

Lockheed Aircraft Service, Inc., P. O. Box 48, Burbank, Calif., kits and spares, (IFB P/R 11631), 58 ea., $33,375.

North American Aviation, Inc., P. O. Box 95, Fresno, Calif., modification IRAN and repair of crash-damaged F-86 type aircraft, (IFB P/R 1933), job, $533,708.

Minneapolis - Honeywell Regulator Co., Aeronautical Div., 2600 Ridgeway Road, Minneapolis 13, Minn., overhaul and modification of altitude control, (IFB PR 598066), 150 ea., $53,016.

Wright-Aeronautical Div., Curtiss-Wright Corp., Wood-Ridge, N. J., technical data, (IFB PR 456918), job, $26,495.

B. F. Goodrich Co., 500 Main St., Akron, Ohio, De-icer, (IFB RFP 36-600-55-5276) (Q), 548 ea., $68,231.

DAYTON AIR FORCE DEPOT, Ohio.

Raytheon Mfg. Co., 55 Chapel St., Newton 58, Mass., tube, electron, receiving, pentode, general purpose, (IFB RFP 33-604-55-3197), 142,400 ea., $259,168.

Lansdale Tube Co., Church Rd., Lansdale, Pa. tube, electron, triode, general purpose, glass envelope JAN 6189/12AU7WA 162,000 ea., tube, electron, transmitting, triode, general purpose, JAN 6100/6C4WA, 5,600 ea., (IFB RFP 33-604-55-3197), $285,868.

CBS—Hytron, Div. of Columbia Broadcasting System, Inc., 100 Endicott St., Danvers, Mass., tube, electron, receiving, diode, general purpose, type 5726/6AL5W/6097, 50,500 ea., tube, electron, JAN type 5814WA, (IFB RFP 33-604-55-3197), 47,000 ea., $111,210.

Tung-Sol Electric Inc., 95 Eighth Ave., Newark 4, N. J., tube, electron, receiving, pentode, JAN 5725/6AS6W/6187, 45,450 ea., tube, electron, receiving, pentode, JAN 6098/6AR6WA, 2,800 ea., tube, electron, receiving, triode JAN 5751 WA, 25,000 ea., tube, electron, triods, JAN 6188/6SU7WGI, (IFB RFP 33-604-55-3197), $216,250.

Daystrom, Inc., Daystrom Instrument Div., Archbald, Pa., tester, capacitance bridge, precision, type ME-1, (IFB PR GE-573725), 16 ea., $51,412.

Sonotone Corp., Elmsford, N. Y., tube, electron, military, control, receiving miniature, twin triode, type 6101/6J6WA, (IFB RFP 33-604-55-2898) 42,000 ea., $105,000.

Sprague Electric Co., Marshall St., North Adams, Mass., resistor, fixed, WW, Meg-O-Max type 1,/1,575 ea., resistor, fixed, composition, Meg-O-Max type 1 MD-88/MPS-4, 350 ea., resistor, fixed, composition, Meg-O-Max type 1, 50 ea., resistor, fixed, composition, Meg-O-Max type 3 13 Meg, 200 ea., resistor, fixed, composition Meg-O-Max type 2, 250 ea., (IFB RFP 33-604-55-3704), $31,310.

WAC Engineering Co., 35 S. St. Clair St., Dayton 2, Ohio, dummy load electrical AN/URM-58, 63 ea., (IFB RFP 33-604-55-3250), $34,357.

General Electric Supply Co., 601 E. Third St., Dayton Ohio, switch box, DPST, 30-amp., 250-v., 314 ea., switch box, knife switch enclosed, 1085 ea., set, contact switch, 230 ea., switch, rotary, 100 ea., switch, knife 200 ea., switch, toggle, 84 ea., switch, toggle, 807 ea., switch, toggle, 70 ea., (IFB PR NOS 553078, 553128, 659911, 589227, 553276), $37,456.

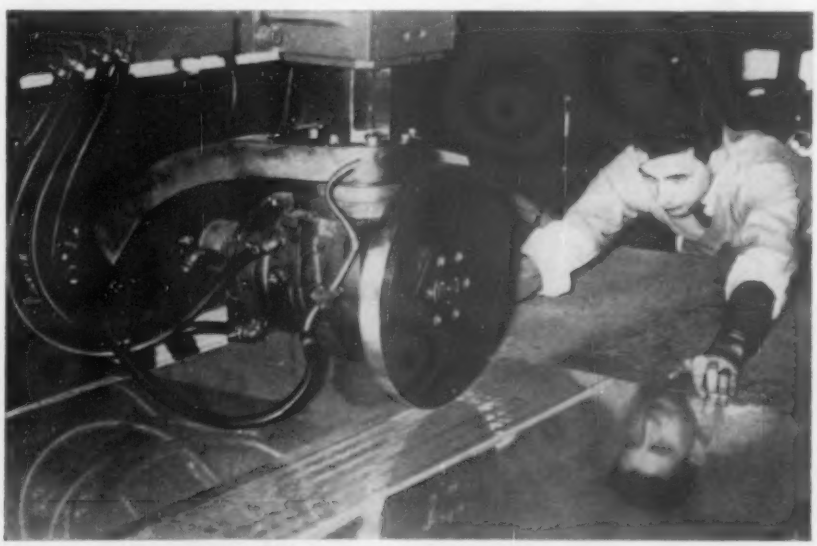
Lewyt Manufacturing Corp., 60 Broadway, Brooklyn 11, N. Y., signal generator, TS-452C/U, 799 ea., (IFB RFP 33-604-55-3216), $438,463.

American Phenolic Corp., 1830 S. 54th Ave., Chicago 50, Ill., modification of test bench groups, air portable, 8 ea., $98,000.

Revere Corp., of America 845 N. Colony Ave., Wallingford, Conn., switch, float, aluminum, Boeing spec. No. 10-1011-3, (IFB RFP 33-604-55-3438), 500 ea., $29,425.

Cosmos Industries, Inc., 31-28 Queens Blvd., Long Island City, N. Y., radio test sets, AN/ARM-10, (IFB MIPR 55-3911-183 Aer), 343 ea., $161,964.

Bruno-New York Industries, 460 W. 34th St., New York 1, N. Y., summation bridges TS-730/URM(956 ea., power measuring kits, summation bridge MX-1310/URM-24, 224 ea., maintenance spare parts, maintenance data, engineering data, electron tube



Big Welder in Sciaky Lab

This Sciaky roll-welding machine, said to be the largest in the world, is one of several types of welding equipment installed in the recently opened laboratory of Sciaky Bros.' Research Division, Los Angeles. The laboratory is devoted to the study of all phases of resistance welding. Two Baldwin-Lima-Hamilton testing machines, with respective capacities of 6,000 and 120,000 lb., are used to test weld strengths.

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Edward Marek
George E. Harris & Co. Inc.
444 Dexer Horton Building
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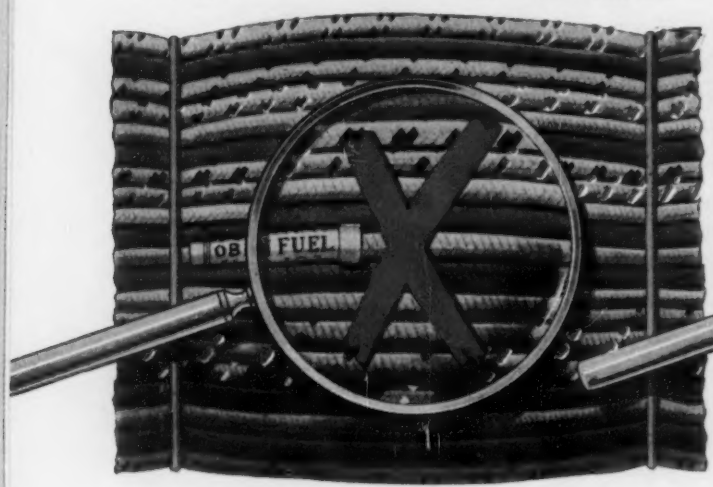
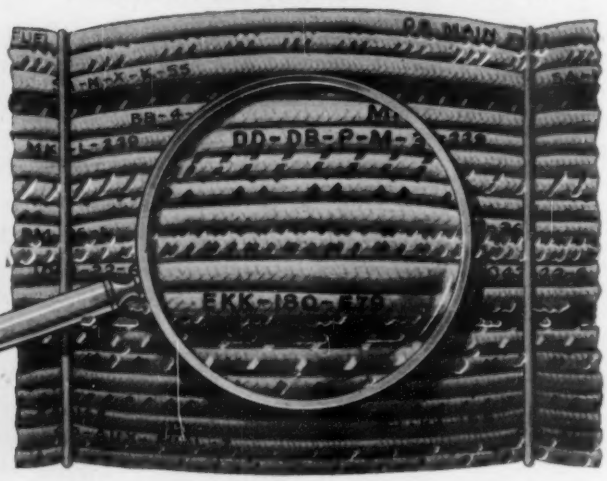
Another Warren Wire First...

WW500 (MIL-W-7139-A) AND COLOR CODED FOR

HARNESS SECTION *WITHOUT* WW500
... ONLY A FEW WIRES CAN BE IDENTIFIED



HARNESS SECTION *WITH* WW500
... *ALL* WIRES ARE EASILY IDENTIFIED



Unique Identification System *Saves Time, Saves Weight, Saves Money!*

Warren Wire is first to introduce this time-saving, money-saving cable identification system to the aircraft and guided missile industry. Now with WW500 (MIL-W-7139-A) Teflon-coated low tension cable, the harness can be broken into at any point and every conductor ***immediately*** identified by stamped numbers or color coding. Never again need electricians put in tedious, costly hours ringing out cable systems or checking identification tags in inaccessible places.

STAMPING — When white Teflon-coated WW500 (MIL-W-7139-A) is used, manufacturers just stamp on their cable identification numbers at about three-inch intervals with standard marking equipment. (White WW500 always available in stock.)

COLOR TRACERS — Good news for guided missile manufacturers is that WW500 can also be obtained in 10 solid colors as well as in an unlimited number of color combinations. This makes it just as easy to identify sheathed as exposed cables, because the same colors can be used in the sheath to identify the individual conductors it contains.

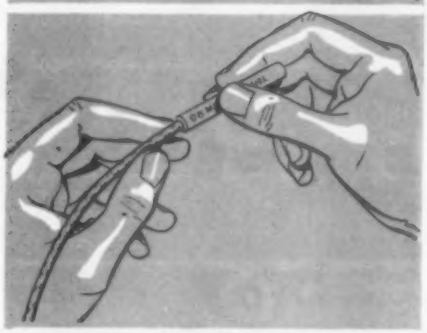
IN ADDITION TO WW500 *Warren Wire contributes to aircraft safety and efficiency with: • Harness Wrapping Tape of 10 Mil Teflon-Coated Glass Fabric with adhesive backing • Teflon-Coated Glass Lacing Cord • Teflon Magnet Wire*

WW500 COLOR TRACER SYSTEM. Protective sheath is color coded to correspond with color of cables it holds.

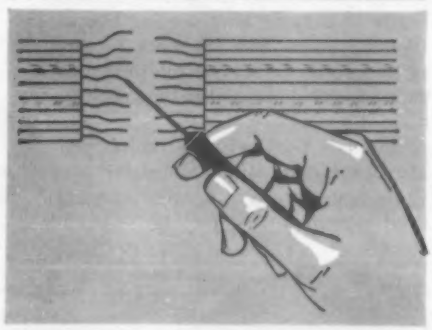
TEFLON CABLE STAMPED IMMEDIATE IDENTIFICATION!

WW500 STAMPED WHITE CABLE. Identification numbers can be stamped on cable automatically with standard marking equipment.

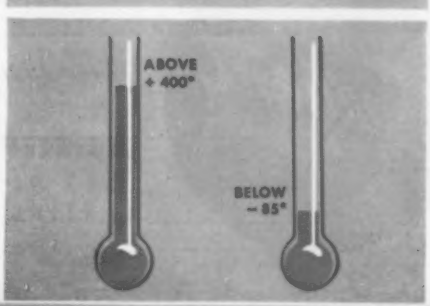
WW500 CUTS ASSEMBLY COSTS. Eliminates tags and clamps. Tagging takes time, piles up labor costs. Tags can and do drop off.



WW500 OUTMODES RINGING OUT. This tedious aural tracer system is now replaced by a remarkably rapid means of visual identification.



WW500 CAN BE USED ANYWHERE. The ideal all-purpose low tension cable, because of its extraordinary heat-and-cold resistant characteristics, and its imperviousness to chemicals and solvents.



Advantages

- Eliminates tagging
- Saves weight
- Eliminates guessing
- Eliminates ringing out
- Cuts assembly costs
- Can be used anywhere

Characteristics

- World's most heat-and-cold resistant cable. Operates efficiently in temperatures *far above* +400°F to *well below* —85°F.
- Impervious to all fuels, chemicals, solvents
- Silver-plated copper conductor

WW

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"Good will" is the disposition of the pleased customer to return to the place where he has been well treated.
—U.S. Supreme Court

complement reports, power measuring kits, summation bridge, MX-1309/URM-23, 732 ea., maintenance spare parts, tabular lists of parts maintenance data, engineering data, electron tube complement reports, reproducible photographic negatives of printed pages of maintenance data, (IFB RFP 33-604-55-3077), $653,165.

Insuline Corp. of America, 186 Granite St., Manchester, N. H., relay test set AN/URM-65, 64 ea., (IFB PR 560952.

MOBILE AIR MATERIAL AREA, Ala.

Aro Equipment Corp., Enterprise & Trevitt Sts., Bryan, Ohio, diagrams, flow indicator, 25,000 ea., $14,750; 25,000 ea., $13,500.

A. Shrader's Son, Div. of Scovill Mfg. Co., 470 Vanderbilt Ave. Brooklyn, N. Y., filler, valve, oxygen, low pressure, 11,836 ea., $39,058.

Utica Div., Bendix Aviation Corp., 211 Seward Ave., Utica 1, N. Y., switch, centrifugal, 168 ea., $10,137; switch assy., 832 ea., $45,044.

Auto-Lite Battery Corp., P. O. Box 931, Toledo, Ohio, batteries, $896,510.

OGDEN AIR MATERIEL AREA, Utah.

Union Switch & Signal Div., Westinghouse Air Brake Co., Swissvale, Pittsburgh, Pa., modification of flight simulators, 20 ea., $936,439.

Link Aviation, Inc., Nolan Rd., Hillcrest, Binghamton, N. Y., modification of flight simulators, 26 ea., $1,875,500.

Engineering & Research Div., ACF Industries, Inc., Hyattsville, Md., modification of flight simulators, 18 ea., $1,280,000.

Cache Valley Electric Co., Logan, Utah, installation of ground control approach facility, job $25,570.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

NAVAL AIR MATERIAL CENTER, PHILADELPHIA 12, PA.

Arde Associates, 14 William St., Newark 2, N. J., design, development and construction of dynamic loading equipment (156/251299/55), 3 lots, $56,175.

CDC Control Services, Inc., 400 S. Warminster Road, Hatboro, Pa., design, development and construction of rapid loading equipment (156/251298/55), 3 lots, $34,800.

Pennsylvania Forge Co., Div. National Cylinder Gas Co., Milnor & Bleigh Sts., Philadelphia 35, Pa., steel rough machined cylinder forging (156/250077/56), 4 ea., $49,000.

Logistics Research, Inc., 141 S. Pacific Ave., Redondo Beach, Calif., digital computer, electronic, general purpose, spare parts kit for maintenance of digital computer, instruction and maintenance manuals, installation services, and indoctrination services, 1 ea., $57,298.

Century Geophysical Corp., 1333 N. Utica, Tulsa 10, Okla., oscillograph, flight test, 10 ea., $28,638.

Santa Fe Tank & Tower, Inc., 5401 S. Boyle Ave., Los Angeles 58, Calif., services and material to furnish counter flow, induced draft type, prefabricated cooling tower on a Govt.-owned concrete foundation, 1 lot, $25,451.

Statham Labs., Inc., 12401 W. Olympic Blvd., West Los Angeles, Calif., pressure transducers, static, dynamic measurement, 168 ea., $42,128.

Delaware Valley Machinery, Inc., 3818 Chestnut St., Philadelphia 4, Pa., vertical turret lathe, 52 in., King machine tool division 52 in. vertical boring and turning machine, 1 ea., $58,339.

American Chain & Cable Co., Inc., Hazard Wire Rope Div., 271 S. Pennsylvania Ave., Wilkes Barre, Pa., launching bridle assy., steel, AM-1, AD aircraft, 1,855 ea., $40,717.

Sanders & Thomas, Inc., 409 Security Trust Bldg., Pottstown, Pa., engineering services in connection with ships installations and aircraft projects, job, $75,000.

Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, Ill., magnetic particle inspection unit, 440 volt, 2 phase, 60 cycle operation, 3 ea.; magnetic particle inspection unit, 220 volt, 3 phase, 60 cycle operation, 2 ea., $121,775.

Emerson Radio & Phonograph Corp., 111 Eighth Ave., New York, radar bombsights, Nos 55-851-f (PD-36-2698-55), 53 ea., $158,630.

Bendix Aviation Corp., Eclipse-Pioneer Div., Teterboro, N. J., adapter amplifiers, disconnect sirvos and gyro horizon indicators, Nos 55-741-f (PD-42-29991-55), various, $94,831.

Morse Instrument Co., 21 Clinton Street, Hudson, Ohio, interval timer, type C-1B, 153 ea., (IFB PR MO-600018), $31,808.

Army Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Army Contracting Offices:

REDSTONE ARSENAL, Ala. July 13.

Tulane Univ. of Louisiana, New Orleans, research study of factors affecting the accuracy of fin-stabilized rockets, job, $49,140.

Chambers Lumber Co., Athens, Ala., revisions to ground floor, north wing, Bldg. 111, job, $33,691.

Aerojet-General Corp., P. O. Box 296, Azusa, Calif., design analysis and design criteria for increment 3 of the pilot lot acceptance test and qualification laboratory facility, job, $87,058.

Clark Bros. Co., Div. of Dresser Operations, Inc., Olean, N. Y., air compressor, horizontal high pressure reciprocating, GFAR motor drive, utilizing 75 hp., Westinghouse motor as per specs., 1 ea., $29,898.

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for perfect soldering
—every time!
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ZEPHYR Electronic
MICROBRAZER
Accurate control of heat with electronic timer assures identically perfect solder joints—time after time. Miniature plugs and receptacles are easy to solder to strict military "specs" with the MicroBrazer. Eliminates problems of overheating and cold joints; gives virtually automatic operation for assembly line soldering. Zephyr sales representatives will be glad to show you—on your assembly line.
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Stock Changes for California Eastern

Acquisition of 27,300 common shares and disposal of 10,500 by the officers and directors of California Eastern Aviation, Inc., is reported in the latest survey of stock transactions by Securities and Exchange Commission.

Samuel Solomon, board chairman and president, had a net acquisition of 18,000 common shares, 15,000 through the exercise of an option. His total acquisition was 25,000 common shares, reduced by a disposal of 7,000 shares, leaving a total holding of 33,555 common shares. Other transactions by California Eastern officials included:

Jorge Carnicero, beneficial owner and director, acquisition of 2,000 common shares, making a total holding of 118,985 shares directly held and 39,122 shares indirectly held through Trans-American Aeronautical Corp.; William Brinckerhoff, director, disposal of 2,000 common shares, leaving a holding of 84,243; Arthur S. Clark, director, disposal of 200 common shares, total holding; Edward Kerbs, director, disposal of 1,300 indirectly-held common shares, leaving a holding of 7,346.

Other transactions reported for the mid-July to mid-August period were:

Aero Supply Manufacturing Co. Walter Dennis, director, acquisition of 100 common shares, total holding: Leo Strauss, director, acquisition of 700 common shares, making a total holding of 7,893.

Air Reduction Co. George V. Slottman, officer, acquisition of 500 common shares, making a total holding of 650; August J. Thoma, officer, acquisition of 1,000 common shares, making a total holding of 1,200.

Aluminum Company of America. Ralph V. Davies, officer, acquisition of 4,000 common shares, making a total holding of 13,230; Donovan Wilmot, officer, acquisition of 12,000 common shares, making a total holding of $20,760.

Aluminum Industries Inc. John H. Hater, director, disposal of 300 common shares, leaving a holding of 1,100.

Boeing Airplane Co. Evan M. Nelsen, officer, acquisition of 100 common shares, making a total holding of 831.

Braniff Airways. Eugene C. Eppley, director, disposal of 10,900 common shares (subsequently contributed to the Eppley Foundation) and acquisition of 900, leaving a total holding of 3,521 common shares, plus 15,021 shares indirectly held through the Eppley Foundation; J. W. Miller, officer and director, acquisition of 300 common shares, making a total holding of 1,506.

Capital Airlines. James B. Franklin, officer, disposal of 200 common shares, leaving a holding of 4,000; Charles H. Murchison, director, acquisition of 200 common shares through the exercise of an option, making a total holding of 20,405.

Chance-Vought Aircraft. Leonard F. McCollum, director, acquisition of 300 capital shares, making a total holding of 800.

Colonial Airlines. A. Charles Schwartz, director, acquisition of 100 common shares, total holding.

Consolidated Electronics Industries. Charles G. Munn, director, disposal of 200 common shares, leaving a holding of 5,300.

Continental Motors Corp. Benjamin F. Tobin, Jr., director, disposal of 500 common shares, leaving a holding of 7,002.

Firestone Tire and Rubber Co. John J. Shea, officer and director, acquisition of 8,000 common shares through the exercise of an option, making a total holding of 35,000; Harold M. Taylor, officer, acquisition of 1,300 common shares, making a total holding of 3,900.

General Electric Co. Ralph J. Cordiner, officer, acquisition of 4,500 common shares, making a total holding of 10,395; Henry V. Erben, officer, disposal of 200 common shares, leaving a holding of 9,605; Henry Ford II, director, acquisition of 100 com-

Copter Replaces Planes for Business Travel

Radio Materials Corp. of Chicago has purchased an executive Bell 47H-1 to replace two company airplanes previously used in inter-plant transportation. Firm says that it spent more time traveling between airports and plants by car than was required to fly between the cities in which its factories were located. It estimates that substitution of the Bell for airplanes will provide 800 hr. additional executive time annually. Firm is making at least one flight daily from a heliport atop its Chicago factory to its Attica, Ind., plant.

supersonic safety

for Americ[illegible] airmen

WEBER EJECTION SEATS PROVIDE SPLIT-SECOND ESCAPE

Two seconds from decision . . . to parachute safety! That's all it takes a pilot of Convair's F-102A all weather, jet interceptor to abandon ship . . . if he gets into trouble . . . even at supersonic speeds. Ejection sequence starts when pilot raises hand grip to dump cabin pressure . . . unlock and jettison the canopy. Another 15° of movement of the hand grip raises forearm guards and locks shoulder harness inertia reel. Pressure on the trigger then *safely* ejects the pilot, and 2 seconds later his lap belt automatically opens freeing him from the seat. The ejection cycle is completed with only 30 lbs. of pressure on the hand grip, so pilot in positive G condition needs only to move his wrist to eject. Weber's design, development and production skills are daily being called upon to solve complex problems like this.

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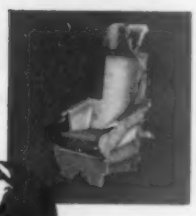

MANUFACTURERS OF: ejection seats · pilot and crew seats · passenger seats / buffets · wash basins and other interior equipment / Aerostands · Aeroramps / subcontractors of major airframe components

WEBER AIRCRAFT CORPORATION

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mon shares, total holding; C. J. Hendon, officer, acquisition of 1,125 common shares through the exercise of an option, making a total holding of 2,415; William R. Herod, officer, acquisition of 1,638 common shares, making a total holding of 6,576; George L. Irvine, officer, disposal of 389 common shares, leaving a holding of 1,048; Cramer W. LaPierre, officer, acquisition of 1,695 common shares, making a total holding of 4,093; Clarence H. Linder, officer, acquisition of 2,070 common shares, making a holding of 4,710; William C. Wichman, officer, disposal of 1,000 common shares, leaving a holding of 997.

General Motors Corp. Paul Garrett, officer, disposal of 119 common shares, leaving a holding of 752; John F. Gordon, officer and director, disposal of 100 common shares, leaving a holding of 1,501; Charles L. McCuen, officer, disposal of 300 common shares, leaving a holding of 5,368.

B. F. Goodrich Co. H. V. Gaertner, officer, acquisition of 1,200 common shares, making a total holding of 6,150; Goldman Sachs & Co., disposal of 1,588 common shares, leaving a holding of 2,000.

Goodyear Tire and Rubber. H. W. Hillman, officer, disposal of 200 common shares, leaving a holding of 2,448; R. G. Woodling, officer, acquisition of 150 common shares, making a total holding of 1,648.

Greer Hydraulics. David Fromson, officer, acquisition of 300 common shares, total holding; Edward M. Greer, officer and director, acquisition of 400 common shares, making a total holding of 45,350; Irving Herzenberg, director, acquisition of 300 common shares, making a total holding of 400; G. Lawton Johnson, officer and director, acquisition of 200 common shares, making a total holding of 500; Julius Kendall, officer, acquisition of 100 common shares, making a total holding of 410; Hugh Lehnacker, officer and director, acquisition of 200 common shares, making a total holding of 210; Robert P. Lord, officer and director, acquisition of 600 common shares, making a total holding of 38,575.

Hoffman Electronics. Howard C. Briggs, director, disposal of 1,000 common shares, leaving a holding of 1,000; Joseph S. McGee, officer, disposal of 250 common shares, leaving a holding of 250.

Lear, Inc. Vernon B. Benfer, officer, disposal of 300 common shares, leaving a holding of 6; Roy J. Benecchi, officer, acquisition of 1,000 common shares, making a total holding of 1,590.

McDonnell Aircraft Corp. James Lee Johnson, director, disposal of 3,200 common shares, leaving a holding of 1,950.

National Airlines. Jean C. Brawner, officer and director, acquisition of 1,200 common shares, making a holding of 2,400; Daniel R. Topping, director, acquisition of 1,000 common shares, making a holding of 1,500.

Northwest Airlines. Malcolm S. Mackay, officer and director, disposal of 500 convertible preferred, leaving a holding of 2,000.

Pacific Northern Airlines. Joseph H. Foster, officer, acquisition of 600 common shares, making a total holding of 2,500; Clarence W. Nelson, officer and director, disposal of 200 common shares, leaving a holding of 1,050; Robert A. Rowan, director, acquisition of 5,1000 common shares, making a total holding of 19,767.

Pan American World Airways. The following acquisitions were by exercises of options: J. T. Trippe, president and director, 9,375 common shares, making a total holding of 38,414; Samuel F. Pryor, executive vice president and director, 1,875, making a total holding of 8,232; Alvin P. Adams, officer, 750, making a total holding of 959; Russell B. Adams, officer, 500, making a total holding of 1,040; Harold M. Bixby, director, 4,000, making a total holding of 11,095; Franklin Gledhill, officer and director, 1,875, making a total holding of 3,627; Harold E. Gray, officer, 1,875, making a total holding of 4,189; John C. Leslie, officer and director, 1,875, making a total holding of 3,269; H. Preston Morris, officer, 312, making a total holding of 1,685; Clarence M. Young, officer, 1,250, making a total holding of 2,141. Disposals of PAA common stock were: R. G. Ferguson, officer, 269, leaving a holding of 634; Henry J. Friendly, officer and director, 1,800, leaving a holding of 2,055; Lehman Brothers, 5,600, total holding.

Piper Aircraft Corp. E. N. Hunting, director, disposal of 100 directly held preferred shares and 500 shares indirectly held

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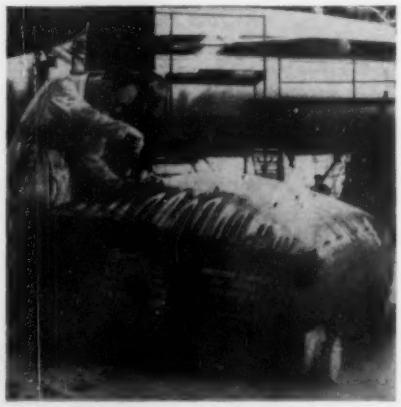

New Britannia Fuel Tank

Fuel tank being fitted into the British Bristol Britannia is made of synthetic rubber reinforced with nylon. Made by Fireproof Tanks Ltd., Portsmouth, England, the tank is said to resist strains and remain sealed even in the event of a crash or forced landing, thus reducing the likelihood of fire.

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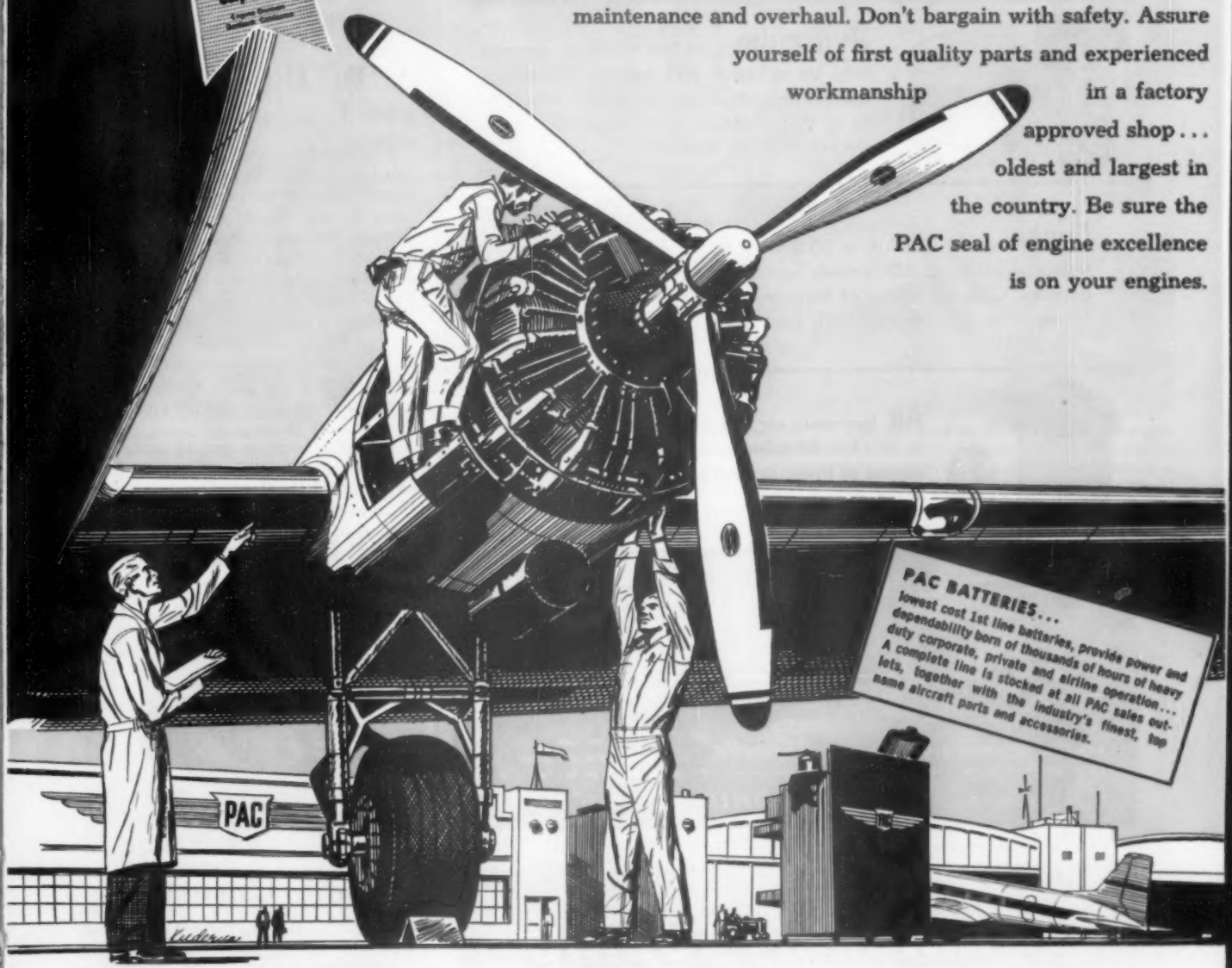
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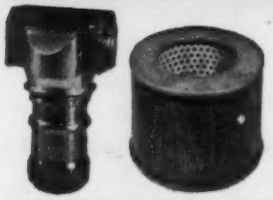
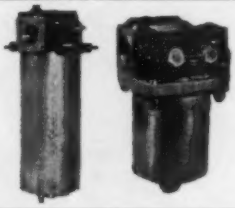
FINER AIR-BORNE FILTERS

FOR EVERY PLANE AND PURPOSE



Hydraulic Complete filters, or elements only. Up to 14,000 p.s.i. burst, to 120 g.p.m., and filtration down to ½ micron*. Efficiency to 99.9%. (MS28720-4, -6, -8, -12; AN6235-1A, -2A, -3A, -4A; AN6236-1, -2, -3, etc.)

Fuel Flow from 3 P.P.H. to 30,000 P.P.H. Housings up to 2,000 pounds operating pressure. Complete range of filtration from ½ micron to 200-mesh screen (74 microns).



Air Instrument air and breather filter application to 10 c.f.m. Filtration for air-driven instruments and venting of hydraulic systems. (AN6240-1, AN5822-1, AN-6237-1, etc.)

*1 MICRON = .000039"

Disc-type Ribbon-type Pleated-type

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- A.I.S.I. X-4130.....AN-WW-T-850A
- A.I.S.I. 1025.....AN-WW-T-846

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through Hunting, Larsen and Dunnells, Inc., total holdings.

Raytheon Manufacturing Co. George L. Langreth, director, acquisition of 200 common shares, making a total holding of 300; Percy L. Spencer, officer, disposal of 2,200 common shares, leaving a holding of 3.

Reynolds Metals Co. Joseph H. McConnell, director, acquisition of 150 common shares, making a total holding of 250.

Ryan Aeronautical Corp. Earl D. Prudden, director, disposal of 300 common shares, leaving a holding of 4,000.

Temco Aircraft Corp. I. Nevin Palley, officer, acquisition of 500 common shares, total holding.

United Aircraft Corp. Joseph P. Ripley, director, acquisition of 500 common shares, making a total holding of 2,000.

United Aircraft Products. Harry Harris, director, acquisition of 600 common shares, making a total holding of 2,181.

ARDC Hires Scientists For Upper Air Study

USAF's Air Research and Development Command has commissioned an Israeli scientist to pursue research related to the effects of human travel through the stratosphere.

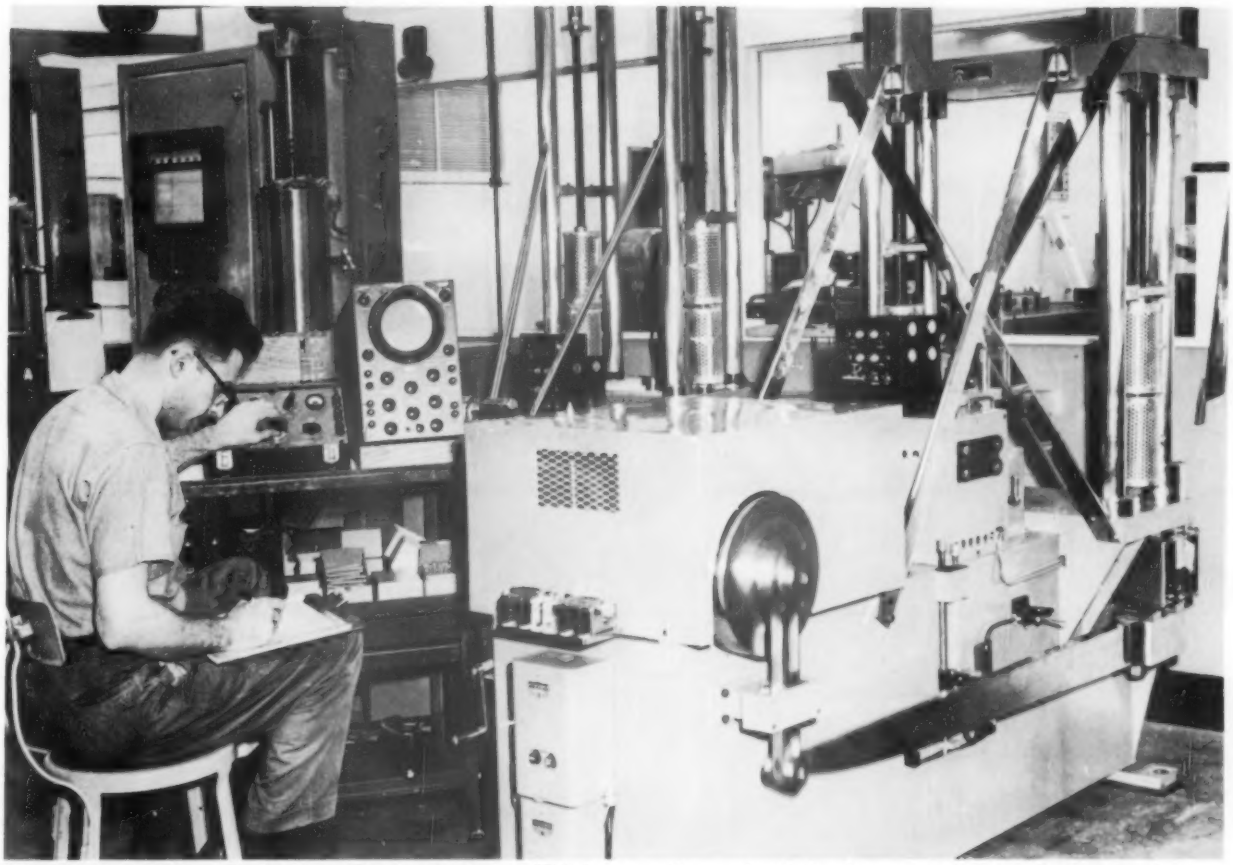
Professor Markus Reiner, who for some time has been investigating the law of the flow of liquids, has recently discovered that certain phenomena, never before observed, were theoretically possible in liquids. His work for ARDC will be to determine whether these phenomena may also be present in the upper layers of air.

Reiner's theory is said to make possible the construction of a centripetal air pump (in contradiction to a centrifugal pump), a device very efficient for viscous or thick liquids. He will build such a pump as part of his research project.

Versatile Camera

Weighing 12¼ lb., this 70 mm. rapid sequence camera provides 2¼x2¼ in. negatives at rates from 5 to 20 per second. Handheld or tripod mounted the instrument is equipped with automatic reflex focusing and designed for quick changing lens mounts. 100-ft. rolls of film provide 470 pictures for each loading. Lenses from 3 to 80 in. focal length have been successfully used. Available for pulse or single frame operation at rates up to 5 per second.

Charles A. Hulcher Co., Inc., 40 Manteo Ave., Hampton, Va.



CHARTING THE UNKNOWN. The Fatigue Testing Center at SPS is considered by many aircraft authorities to be second in capacity for bolt testing only to the one maintained by the Air Force at Wright Field in Ohio. The cycle-stress graphs shown are the result of the first conclusive tension-tension fatigue tests ever made of titanium aircraft fasteners. To determine a single point on the fatigue curve—the endurance limit of a specimen—required almost 7 full days of test machine time.

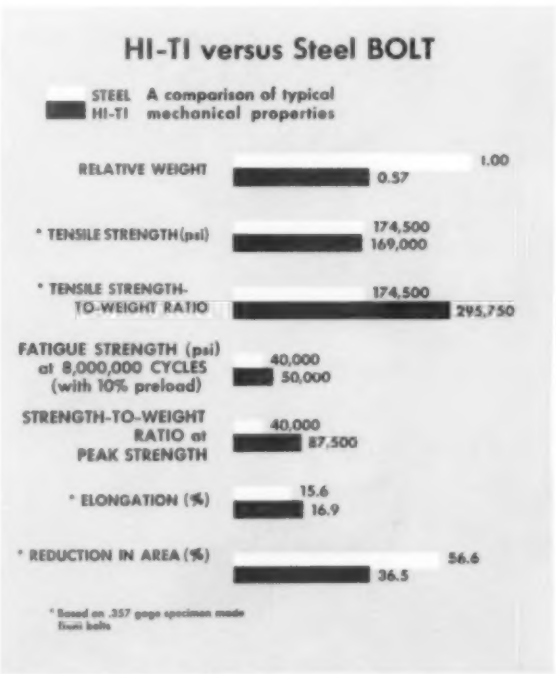
SPS RESEARCH PROGRAM DEVELOPS HI-TI TITANIUM AIRCRAFT BOLTS

New Tension and Shear Bolts Equal or Excel Steel in Tension-Tension Characteristics

The successful application of titanium to tension and shear bolts is the result of 30 months' intensive research and development in the SPS plant. These new Hi-Ti Bolts are designed to replace present alloy steel bolts used in critical fastening jobs in aircraft applications. In tension-tension characteristics these bolts equal or excel alloy steel bolts of the same type. And since they weigh only 57% as much, one pound of them can do the work of just about 1¾ pounds of alloy steel bolts. Weight saving without loss of strength can range as high as 1000 pounds in a single plane.

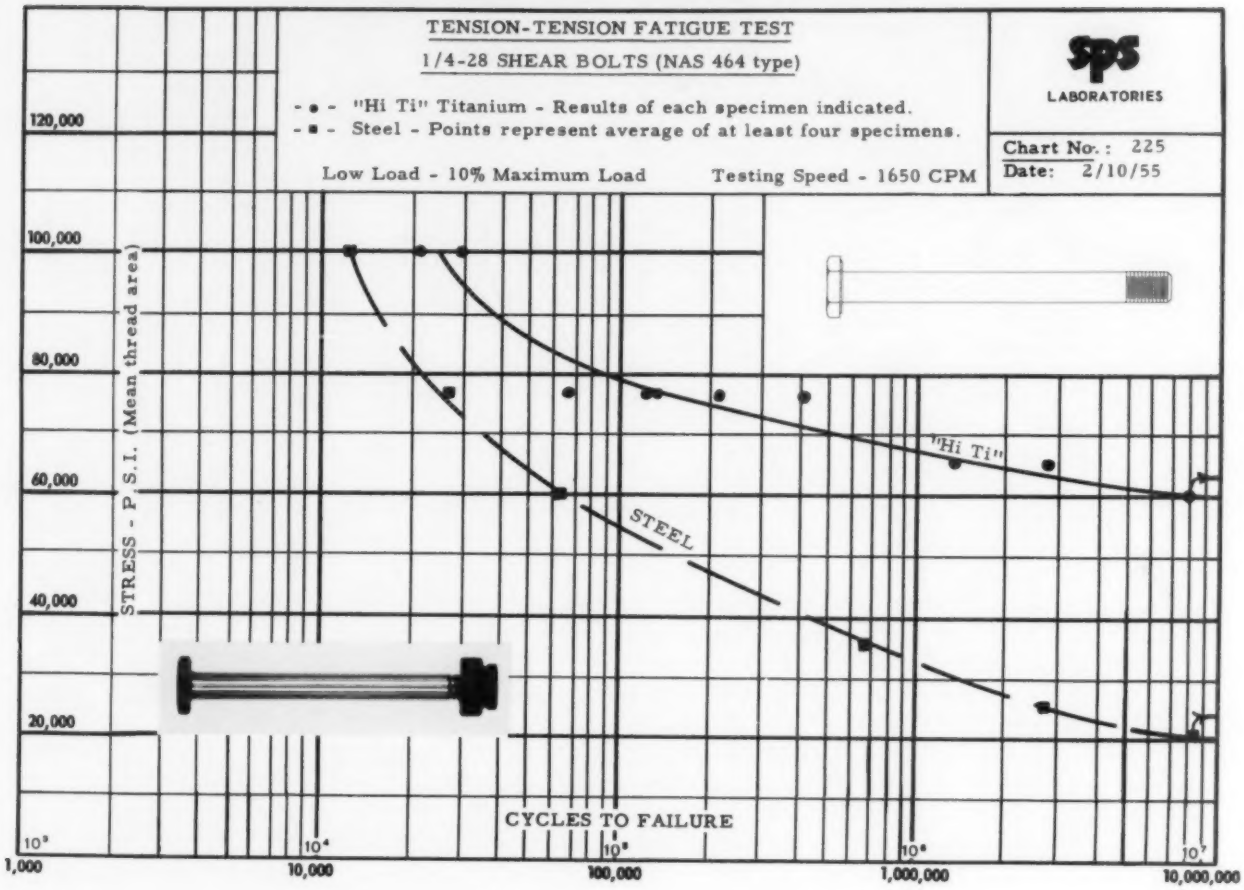
Not only does SPS have the laboratory facilities to supply complete tension-tension test data with each shipment, but it is set up to take research contracts when they fit into your work on fastener development problems. Aircraft Products Division, STANDARD PRESSED STEEL Co., Jenkintown 3, Pa.

AIRCRAFT PRODUCTS DIVISION SPS

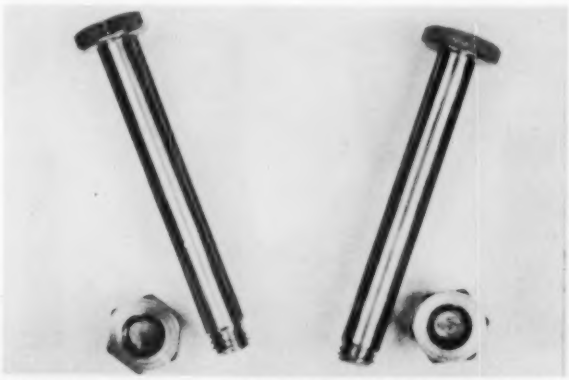


Hi-Ti vs. Steel. Tensile, elongation and reduction area properties are based on performance of bolt gage specimens. Endurance limit was determined by subjecting bolts to tension load alternating between maximum and 10% preload for a total of 8,000,000 cycles without inducing failure. Significant comparison is strength-to-weight ratio at endurance limit.

STANDARD PRESSED STEEL CO., Jenkintown, Pennsylvania



1/4-28 NAS 464 Steel Shear Bolts failed at the junction of the body and the head.



1/4-28 Hi-Ti Titanium Bolts (NAS 464 Type) failed in the threads near the nut bearing face, two to three full threads from the thread runout.

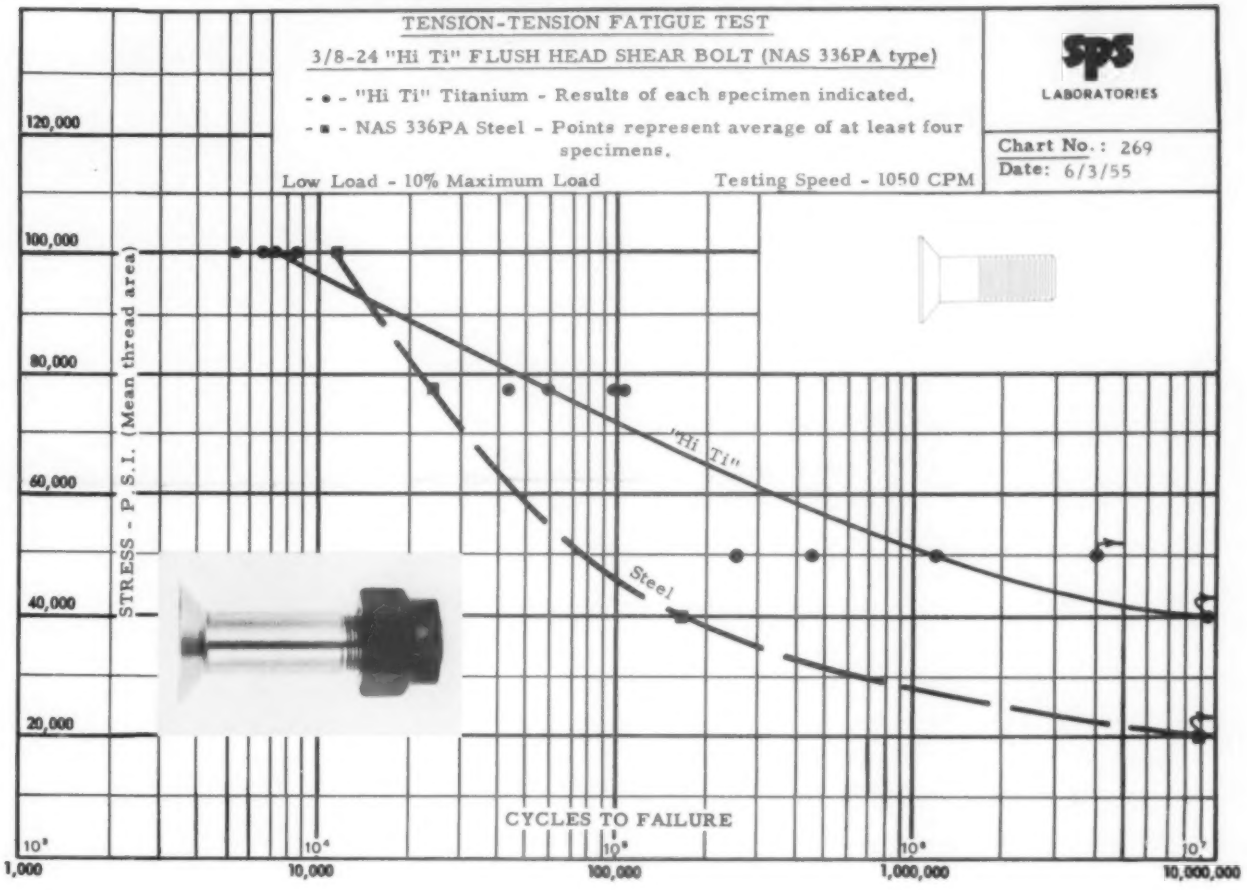
A COMPARISON OF THE MECHANICAL PROPERTIES OF SHEAR BOLTS

(NAS 464 Type)

	¼-28 DIAMETER	
	Steel AMS-6322	"Hi Ti" Titanium (4A1-4Mn)
TENSILE STRENGTH (psi)		
Root Thread Area	223,100	193,200
Mean Thread Area	200,800	174,000
Pitch Thread Area	179,500	155,500
.113 Gage Specimen	179,450	155,000
YIELD STRENGTH (psi)		
Root Thread Area	202,200	159,500
Mean Thread Area	182,100	143,600
Pitch Thread Area	162,800	128,400
.113 Gage Specimen	157,600	126,500
ELONGATION, % in 4 Dia.		
.113 Gage Specimen	18.0	16.7
REDUCTION IN AREA, %		
.113 Gage Specimen	54.5	41.0
SHEAR STRENGTH (psi)		
Bolt Body	117,100	109,200
FATIGUE STRENGTH (psi) @ 8,000,000 CYCLES		
10% Preload	20,000	60,000
STRENGTH WEIGHT RATIO*		
Ultimate Strength	179,450	271,250
Endurance Limit	20,000	105,000

* Using the density of steel as unity (density of steel 0.28 lb/cu in and of titanium 0.16 lb/cu in)

STANDARD PRESSED STEEL CO., Jenkintown, Pennsylvania



3/8-24 NAS 336P Steel 100° Flush Head Shear Bolts with Phillips recess which failed in fatigue tests.

3/8-24 Hi-Ti Titanium Flush Head Shear Bolts with Phillips recess which failed in fatigue tests.

A COMPARISON OF THE MECHANICAL PROPERTIES OF FLUSH HEAD SHEAR BOLTS

(NAS-334 Type)

	⅜-24 DIAMETER	
	Steel AMS-6322	"Hi Ti" Titanium (4A1-4Mn)
TENSILE STRENGTH (psi)		
Root Thread Area	202,720	195,920
Mean Thread Area	187,215	189,935
Pitch Thread Area	180,815	174,750
.252 Gage Specimen	178,355	164,330
YIELD STRENGTH (psi)		
Root Thread Area	164,400	154,510
Mean Thread Area	151,825	142,695
Pitch Thread Area	146,640	137,820
.252 Gage Specimen	157,315	147,295
ELONGATION, % in 4 Dia.		
.252 Gage Specimen	11.8	17.2
REDUCTION IN AREA, %		
.252 Gage Specimen	49.6	33.7
SHEAR STRENGTH (psi)		
Bolt Body	116,850	108,695
FATIGUE STRENGTH (psi) @ 8,000,000 CYCLES		
10% Preload	20,000	40,000
STRENGTH WEIGHT RATIO*		
Ultimate Strength	178,355	287,575
Shear Strength	116,850	190,215
Endurance Limit	20,000	70,000

* Using the density of steel as unity (density of steel 0.28 lb/cu in and of titanium 0.16 lb/cu in)

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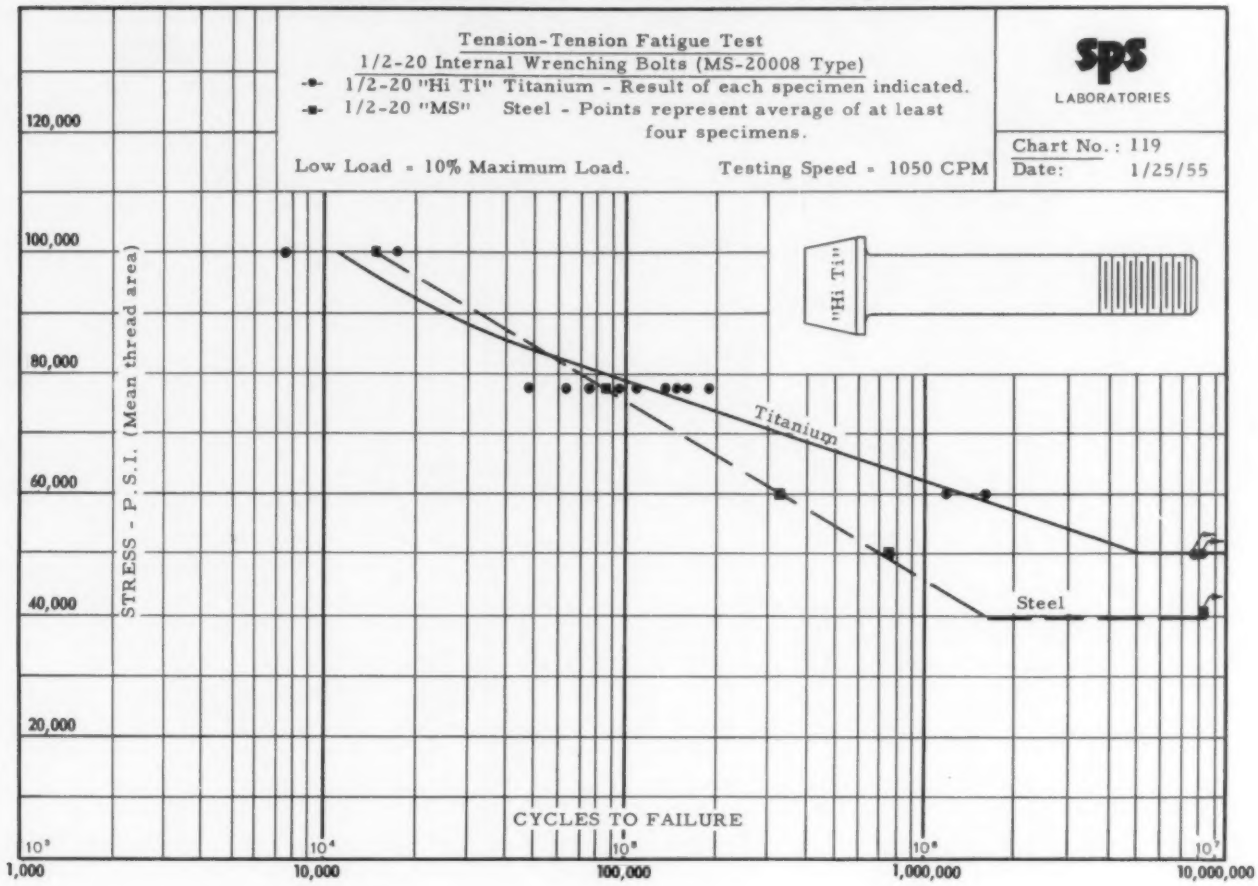

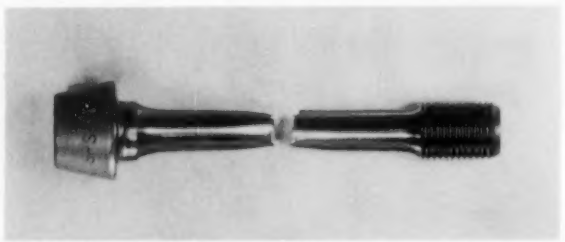

Failed .357 tensile specimen machined from ½-20 Hi-Ti Titanium Internal Wrenching Bolt.

1/2-20 Titanium Internal Wrenching Bolts which failed in fatigue test. Note that all failures were located in the threads near the nut bearing face, three to four threads from the thread runout.

A COMPARISON OF THE MECHANICAL PROPERTIES OF ½-20 DIAMETER INTERNAL WRENCHING BOLTS

(MS20008 Type)

	SPS M.S. Steel AMS-6322	"Hi Ti" Titanium (4A1-4Mn)
TENSILE STRENGTH (psi)		
Root Thread Area	200,000	171,000
Mean Thread Area	187,500	159,000
Pitch Thread Area	174,000	147,850
.357 Gage Specimen	147,500	169,000
YIELD STRENGTH (psi)		
Root Thread Area	183,500	162,000
Mean Thread Area	171,000	150,500
Pitch Thread Area	159,000	140,000
.357 Gage Specimen	162,000	153,000
ELONGATION, % in 4 Dia.		
.357 Gage Specimen	15.6	16.9
REDUCTION IN AREA, %		
.357 Gage Specimen	56.6	36.5
SHEAR STRENGTH (psi)		
Bolt Body	110,000	103,750
FATIGUE STRENGTH (psi) @ 8,000,000 CYCLES		
10% Preload	40,000	50,000
STRENGTH WEIGHT RATIO*		
Ultimate Strength	174,500	295,750
Endurance Limit	40,000	87,500

* Using the density of steel as unity (density of steel 0.28 lb/cu in and of titanium 0.16 lb/cu in)

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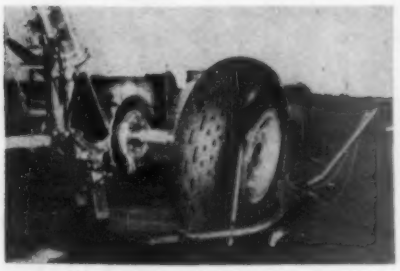

"Y" Dolly Mounts Aircraft Wheels

Developed for aircraft tire and brake-drum assembly, this aircraft dolly enables one mechanic to mount, demount and truck aircraft landing wheels faster and safely. The dolly's T-handle controls load and maneuvering or trucking on 6 in. ball bearing rubber wheels. The screw jack lifts and lowers 40 to 56 in. aircraft tire and brakedrum assemblies while hinged front rollers assume angle of axle on jack and line up for mounting.

Manufactured by Cam Tool Co., 11 Randwick Ave., Oakland, Calif.

Propeller Feathering Hose Assembly

Fireproof propeller feathering hose assembly is available in pressure and supply lines.

Pressure lines are 680 high pressure hose assemblies fitted with asbestos covering over hose and fittings and have a 12,000 psi. minimum burst rating. Recommended for 3,000 psi. operating pressures. Supply lines are lightweight 601 engine. hose with operating temperatures of −65 to 300 F.

Assemblies are CAA approved for installation on commercial aircraft and comply with current fire resistance requirements.

Manufactured by Aeroquip Corp., Jackson, Mich.

New Lightweight Hydraulic Pumps

Positive-piston-return type hydraulic pumps are available in both constant delivery and variable delivery models. Series 65 pumps were designed to meet military aircraft and missile applications. Rated at 1,500 rpm., they perform at speeds up to 10,000 rpm. and inlet pressures equivalent to 65,000-ft.

Constant delivery models are available in sizes from 0.5 to 3 gpm and variable models from 0.25 to 1 gpm.

Manufactured by Stratopower Section, New York Air Brake Co., Watertown, N. Y.

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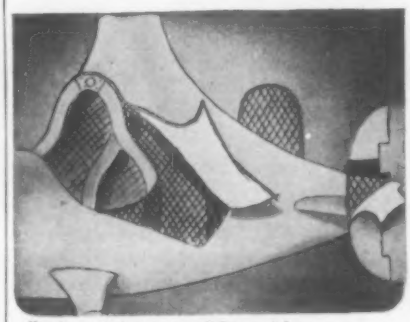

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VORTEX GENERATORS of the A4D-1 (arrows) help to reduce high-speed buffeting.

Tiny Navy Skyhawk Steals Show At Big National Aircraft Display

Philadelphia—The star of the static aircraft display at the 1955 National Aircraft show was the Navy's tiny Douglas A4D-1 Skyhawk which reputedly can carry a load equal to its own weight.

The A4D on display—it had just been placed aboard the USS Ticonderoga for carrier suitability trials—showed some changes from earlier Skyhawks, particularly 18 vortex generators on each wingtip near the leading edge, six near the wing-root trailing edge and six more on the lower side of the fuselage near the wing root. The modification reduces buffeting in the high-speed range.

The Skyhawk carries 533 gal. of fuel in its small delta wings and 237 gal. in the fuselage behind the cockpit, for 2.75 hr. duration. Two 150-gal. or one 300 gal. auxiliary tank can be carried under the wings or fuselage. Armament is two cannon mounted in the wing roots.

The A4D had tough competition for crowd attention from a rebuilt World War I Sopwith Camel F.1 owned by Cmdr. Frank Tallman, USNR, which was parked by the tiny Navy attack plane.

Other Navy planes on show:

Chance Vought YF7U-3 Cutlass, North American FJ-4 Fury, Douglas A3D-1 Skywarrior, Grumman F9F-8, F9F-6 and Cougar and S2F-1, Lockheed WV-2 and P2V-6 Neptune with underwing Westinghouse J34 turbojets and a Piasecki HUP-2 copter.

Air Force Display

Newest planes shown on the ground by the USAF were the Lockheed C-130 Hercules turboprop combat transport, the 16-ton turbine-powered Piasecki YH-16A helicopter—an impromptu addition to the show—the pantobase Stroukoff YC-123E and a North American F-100A Super Sabre.

The Air Force also displayed a Convair RB-36H, on which the 20-mm. gun turrets were extended, the Republic F-84F Thunderjet, Boeing B-47E and a KC-97E tanker fitted with four 1,800-gal. fuel tanks in the cabin for air-to-air refueling. This tankage and the plane's own fuel total 15,000 gal., Aviation Week was told. The KC-97E has a cruise range of about 14 hr.

Also a Lockheed F-94C Starfire and RC-121D radar picket; a Martin RB-57A, a Northrop F-89D Scorpion, North American F-86D and F-86F, Piasecki YH-21 fitted for blind flying, Fairchild C-119G and C-123B, Douglas C-124A, Convair T-29C and C-131A. In the missile department there was a brightly red painted Martin TM-61A Matador tactical missile on its mobile launcher. The Matador's crew ran the missile's Allison J33 turbojet several times during the show.

The National Advisory Committee for Aeronautics was represented by a Boeing EB-29A carrying the record-breaking rocket-powered Bell X-1B in its belly. Small X-1B silhouettes painted on the nose showed that the Superfort has dropped the research plane 33 times. On the 10th drop Maj. Charles Yeager achieved 1,650 mph.; on the 24th drop Maj. Arthur Murray went to 90,000 ft.

Marine Developments

The U. S. Marines borrowed the twin-engine Sikorsky from the factory for the high-point of their ground display. The cabin of the heavily-instrumented copter was barred to visitors, who were only permitted to peer in the open cabin door. The Marines

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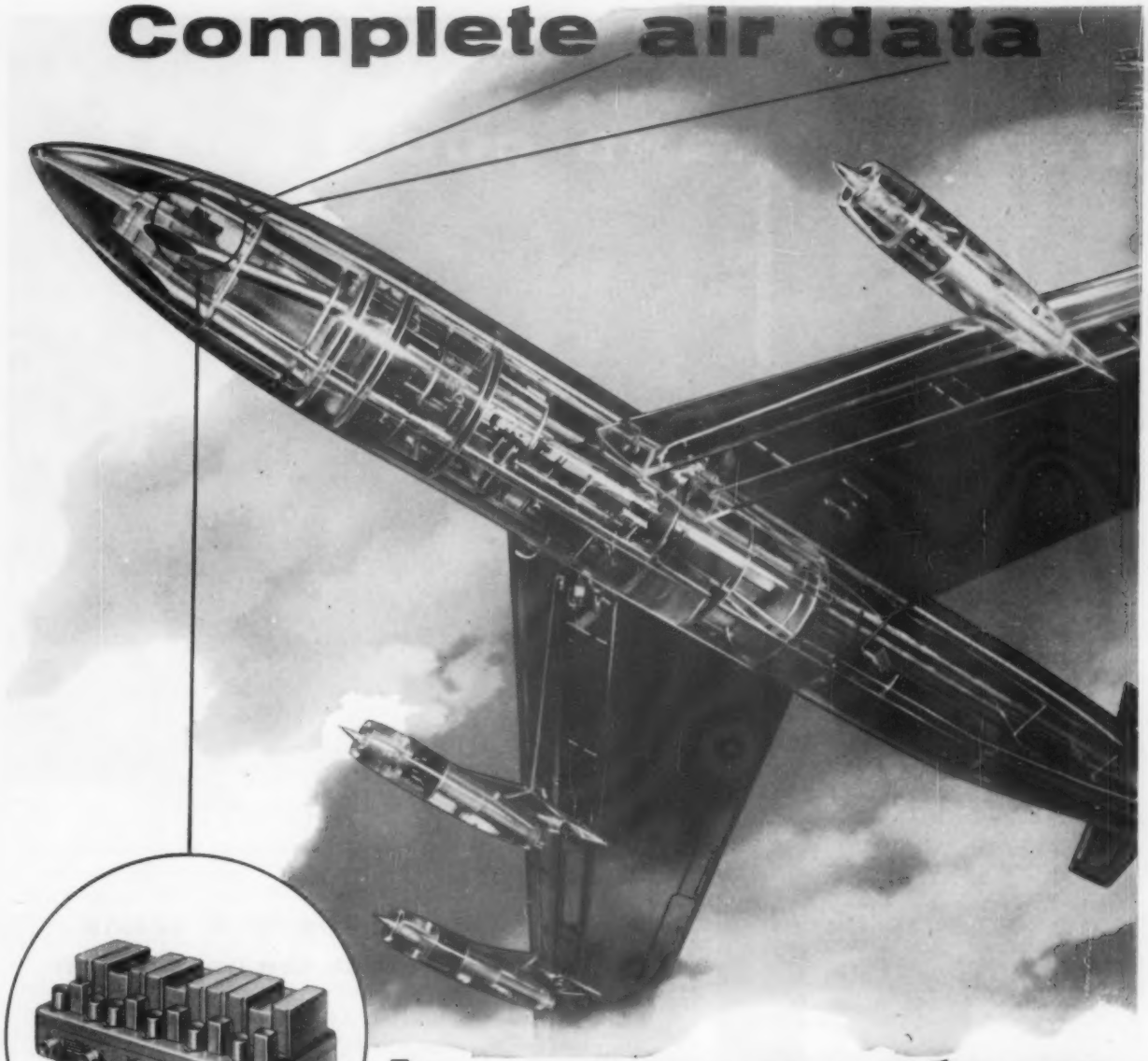

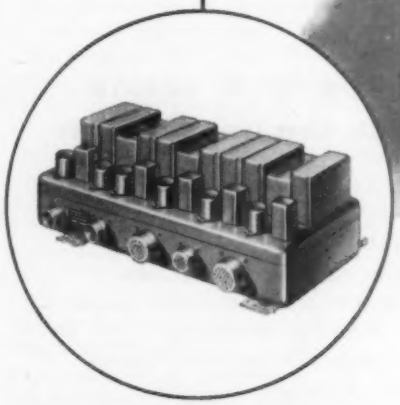

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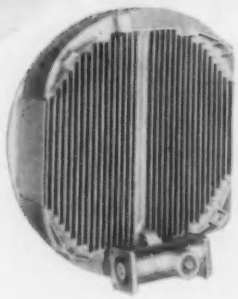

TEMPERATURES MADE TO ORDER

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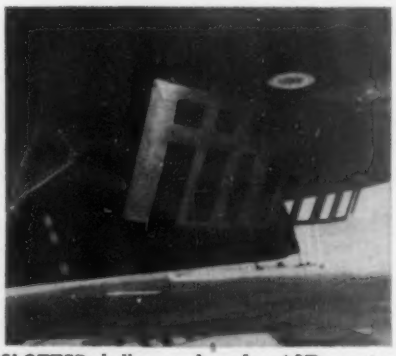

SLOTTED belly panel under A3D creates turbulence for improved bomb release.

also displayed a rocket-armed Douglas AD-5 Skyraider, North American FJ-2 Fury, Grumman F9F-6P and F9F-8 Cougar, McDonnell F2H-4 Banshee fitted with an air-to-air refueling probe, Fairchild R4Q-2 Packet and the Kaman HOK-1 and Sikorsky HRS-2 Helicopters, the latter fully camouflaged.

Marine developments in combat aviation mobility was highlighted by exhibits of air-transportable shelters, a bulk fuel tank farm now undergoing evaluation and further development and a plastic combat information center.

Their description:

• Geodesic Shelter domes are of 36-ft., 42-ft., 55-ft. and 117-ft. diameters and comprise framework of aluminum extrusions weighing about 1,300 lb., supporting a Geon and Nylon skin weighing approximately 170 lb. which is electronically welded by Domestic Film Products, Millensburg, Ohio. The shelter can be assembled by six men in approximately one hour.

• **Assault bulk fuel system** underwent its first field trials in Puerto Rico in support of Marine Air Group 32 flying FJ-2 Furies last February. During the exercise, the 8th Fuel Company, 2nd Combat Service Group, set up five tank farms and five booster station in 24 hr., providing a capacity of 300,000 gal. for MAG-32's aircraft and vehicles. Marine officers told Aviation Week that the equipment worked without a hitch and that several other Marine supply units will receive the systems for further study. It will be sent also to the Antarctic for various cold weather trials.

Fuel is stored in two types of rubberized nylon collapsible fuel cells, of 3,000-gal. and 10,000-gal. capacity. Bags are made by Goodyear Tire & Rubber Co.

Power equipment of the system includes a 350-gpm. self-priming fuel dispensing and transfer centrifugal pump made by Gorman-Rupp Co., Mansfield, Ohio; a 225-gpm. water separator and filter made by the Warner Lewis to the Antarctic for cold weather trials. Okla., and a meter and strainer produced by Ralph N. Brodie Co., Inc., of San Leandro, Calif. The unit takes three single-point refueling hoses.

• **Combat information center** is an air-transportable, heated and air-conditioned fibrous glass structure weighing 2,500 lb. It can be assembled by six men in 45 min. Known as the S-106/TSQ-6, the panelized shelter can be varied in size by inserts, from 20 ft. x 20 ft. to 20 ft. x 60 ft.

Army Display

Helicopters predominated in the Army's display, comprising six of the nine aircraft and one missile, Nike. Shown were:

A Sikorsky H-34A borrowed from the factory prior to official delivery and an H-19C, Piasecki H-21C and H-25A, Bell H-13E, Hiller H-23B. Fixed wing aircraft included a Cessna L-19A, de Havilland-Canada L-20 Beaver and a Beech L-23B.

The H-34A carried a placard with these brief specifications—gross weight, 11,867 lb., 227 gal. of fuel, 16 seats.

The Army also listed prices on most of its aircraft: H-34A, $194,100; H-25A, $220,300; H-19C, $144,000;

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MIL-E-5400	Electronic Equipment, Airborne
MIL-E-8189	Electronic Equipment, Pilotless
MIL-I-6181	Electronic Equipment, Interference
MIL-STD-108	
MIL-STD-202	
MIL-L-770	Radioactive Material
MIL-L-25412	Luminescent Material—Fluorescent

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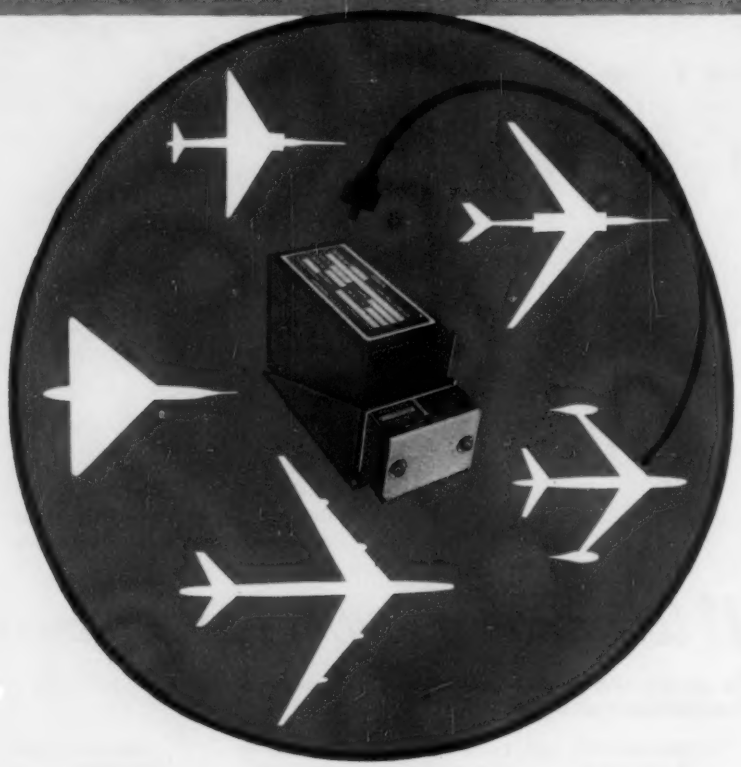

Now a solid coaxial cable linked to a control assembly designed without electronic tubes or complex mechanisms assures maintenance-free service with least amount of personnel training. Low impedance operation eliminates possibility of false alarms due to moisture or capacitive effects in the new EDISON aircraft fire detection system.

Another important development from the world-famous EDISON Laboratory that increases the reliability of this system is its ability to signal fire even with a break in the sensing cable.

Check these other outstanding features, too:

- **direct operation** – from 28 volts d.c. without amplifiers of any kind.
- **rapid response** – signals "Fire Out" automatically; responds repeatedly to fire exposure.
- **extreme flexibility** – permits installation in irregular and inaccessible spaces.
- **maximum versatility** – a single detector circuit may have varying temperature alarm points.
- **simple to install, easy to maintain**–exclusive spring clamps reduce cable installation to seconds, and there are no brittle parts to fracture in the easily flexed cable.

Here is the finest fire detection system . . . especially designed for today's high-speed, high-performance aircraft. *Write today for complete details.*

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H-23B, $40,000; L-20, $46,200; L-23B, $83,000.

Only two new business planes were available for inspection: the new Aero Design & Engineering Corp. Aero Commander 680 with supercharged Lycomings, which will sell for $84,500. Deliveries begin next February. The other ship was the Royal Gull amphibian (AW Aug. 29. p. 70), which had just returned from a tour of the Gulf states.

The Gull suffered some slight damage when children attending the display entered the cabin after the show's end and accidentally retracted the tail wheel.

Indoor Display

Inside the exhibition hangars exhibits by 82 aircraft firms and suppliers were spread over 23,500 sq. ft. of booth space, with 10 General Electric Co., divisions occupying some 2,100 sq. ft. alone.

The public eye was captured by a cutaway plastic J47 that continuously expanded and contracted to show the relation of the components. Children were busy operating switches that maneuvered a tiny model airplane, while a B-47 radar tail turret's twin cannon tracked the model. Pressing a button resulted in firing noises and gun barrel recoil.

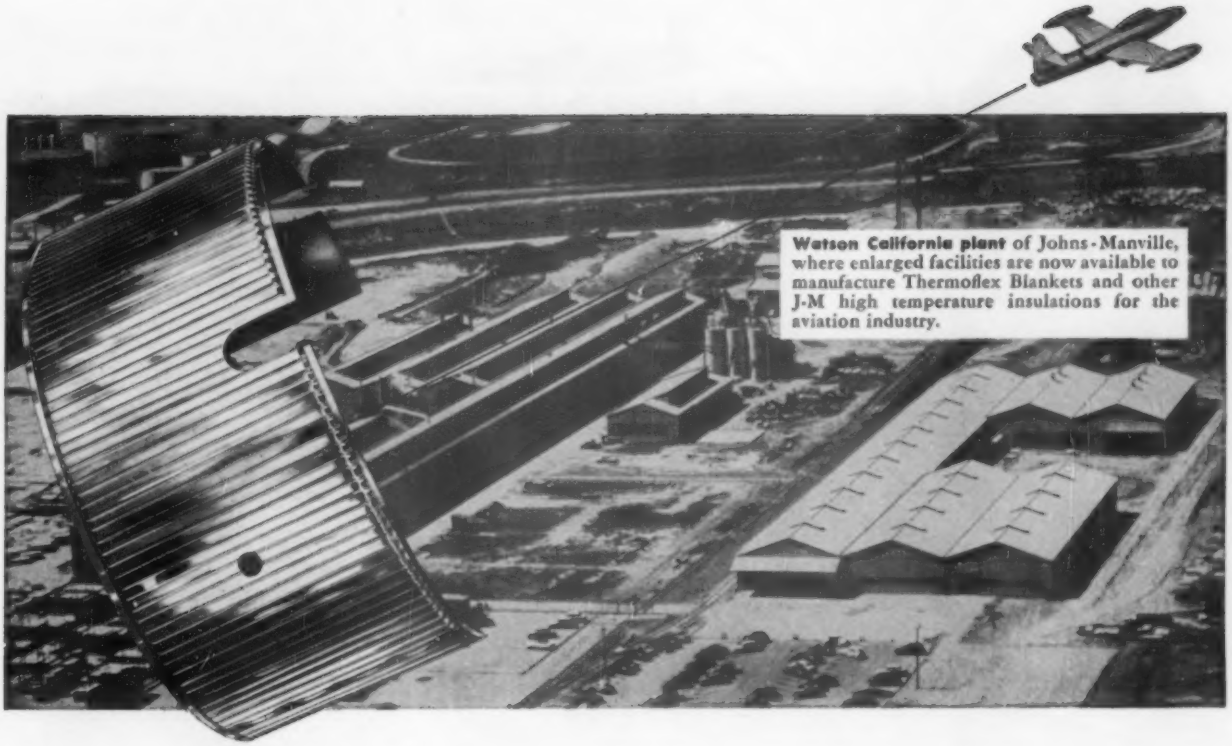
Other highlights that were seen at the GE show:

A rate-of-flow transmitter for inflight refueling designed to measure up to 600,000 lb. of fluid/hour. It appears to be much larger, but basically similar equipment to the firm's mass flow meter system. The new unit is in production, AVIATION WEEK learned.

Not yet in production, but on display was a GE servo indication temperature system teamed with a stainless steel thermocouple harness for providing the pilot turbojet powerplant operating information. Another new unit, in production, is an earth inductor compass transmitter for installation in thin-winged aircraft. This would be teamed with GE's KJ-4 remote compass.

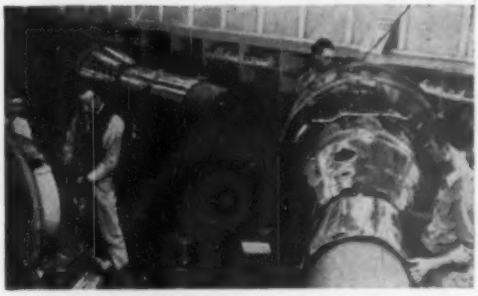
The Allison Division of General Motors displayed for the first time anywhere a J71-A-11 jet which is in the Douglas B-66, Martin XP6M-1 and McDonnell F3H-2N. The 10,000-lb.-thrust-class engine was taken from the assembly line for the show and was scheduled to be returned to the factory for its qualification runs before shipment. The afterburner version is the J71-A-2.

A new development in large helicopter rotor blades was shown at the Aluminum Company of America's booth, which displayed a section of one-half of an extruded rotor blade for

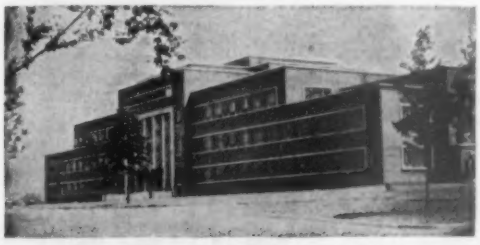


Watson California plant of Johns-Manville, where enlarged facilities are now available to manufacture Thermoflex Blankets and other J-M high temperature insulations for the aviation industry.

Johns-Manville expands production to make Thermoflex Insulating blankets



Precision-fabricated to your specifications, Thermoflex Blankets serve as insulations for tail pipes, engine cones, turbine casings and other assemblies. These blankets combine maximum stability, light weight and low thermal conductivity.



Backed by the World's largest insulation laboratory—located at the J-M Research Center, Manville, New Jersey. Both East and West Coast manufacturing facilities are co-ordinated with the design and technical services of this laboratory, to solve your thermal insulation engineering problems.

Enlarged facilities plus J-M insulation engineering service teamed to solve Aviation Industry's internal insulation problems

Johns-Manville has expanded its manufacturing operations to meet the aviation industry's increased demands for Thermoflex* Blankets. With its new production capacity at Watson, California—in addition to other manufacturing facilities at Manville and Roselle, New Jersey—Johns-Manville now has production facilities on both the West and East coasts.

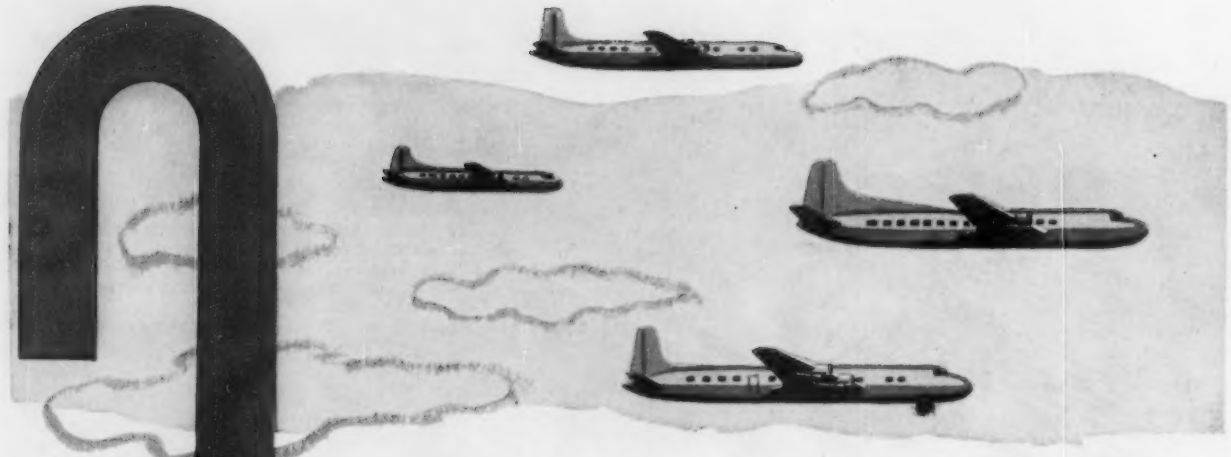
These custom-made blankets, developed by Johns-Manville, have gained wide acceptance for insulating, protecting and fireproofing aircraft against the intense heat of jet power. Moreover, to meet present and future needs, other J-M high temperature insulations are available, and new and improved products are constantly being developed.

The aviation industry can also draw on the insulation design and engineering services offered by Johns-Manville. Through its technical personnel, Johns-Manville can help solve your thermal insulation problems . . . and specify insulating materials tailored to your most exacting needs.

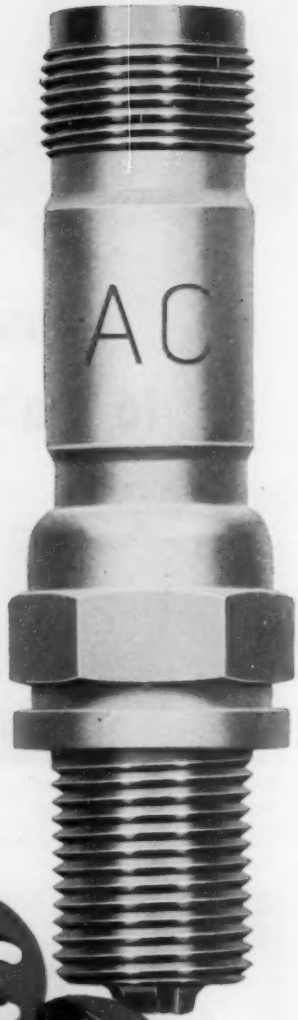
You can avail yourself of this complete insulation engineering service simply by calling the nearest J-M district office. Or write to Johns-Manville, Box 60, New York City 16, New York.

*Thermoflex is a Johns-Manville registered trademark

Johns-Manville PRODUCTS FOR THE AVIATION INDUSTRY



3 great reasons why more and more airlines are switching to AC AIRCRAFT SPARK PLUGS!



For years the aircraft industry has searched for a spark plug with the following three characteristics:

1. A plug that reduces the chances of "blow-by" – prevents combustion gases from escaping through the seal between center electrode and insulator.
2. A plug that can be used – then, cleaned and safely used again.
3. A plug that resists fouling under all operating conditions.

And, now all three of these vitally important characteristics are built into every AC Aircraft Spark Plug!

"Blow-by" is virtually eliminated by AC's exclusive, patented "Conducta-seal" feature—a current-conducting seal of unusual strength and permanence made of metal and ceramic materials – fused together.

Complete sets of AC-271 plugs have been used in commercial planes for well over 900 hours of operational engine time . . . more than twice the life of ordinary plugs under identical operating conditions.

AC's exclusive recessed tip is "self-cleaning." Its unique electrode and thin-tip insulator design clears away combustion deposits as soon as they form!

All these benefits are yours with AC Aircraft Spark Plugs!

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Piasecki's YH-16 helicopter. Sections are extruded in 100-ft. lengths on a 14,000-ton press at Lafayette, Ind. First of the sections was shipped to the copter manufacturer a week before the show.

Piasecki then finishes the extrusions and joins them, using a honeycomb filler.

Boeing KC-135

Alcoa also displayed a Boeing KC-135 jet tanker-transport wing spar attachment aluminum forging made on a 35,000-ton press. The item starts out as a six-foot billet and is made in four passes.

A different approach to helicopter rotor blades was evident at Prewitt Aircraft Co.'s display. Among the various items:

An experimental blade for the Piasecki HUP with a stainless steel D nose cap and a honeycomb sandwich aft section of 0.0007-in. hexcel aluminum covered with a fibrous-glass skin.

The hexcel aluminum weighs 3.1 lb./cu. ft. Developed under a Navy contract, the blade weighs 2.54 lb./ft. and its center of gravity is 22.7% of chord.

The current stainless steel blade on the HUP weighs 2.78 lb./ft. and its CG is 28% of the 13-in. chord. There is also a marked increase in the fatigue resistance of the new blade because of fibrous glass construction.

The stainless blade can take only 6 psi. internal pressure, while the honeycomb blade takes 20 psi., AVIATION WEEK was told.

Army is satisfied with the blade on its H-25 copter, but Navy was concerned because of the vibration stresses imposed on its equivalent HUP blades while the copter hovers over a flight deck.

Prewitt also is building 12 flight-test blades for the YH-16 using a stainless steel laminated spar, honeycomb aft section and aluminum skin. The weight was reported to be 7.56 lb./ft. of blade and CG of the 28-in. chord is reported at 25.2%.

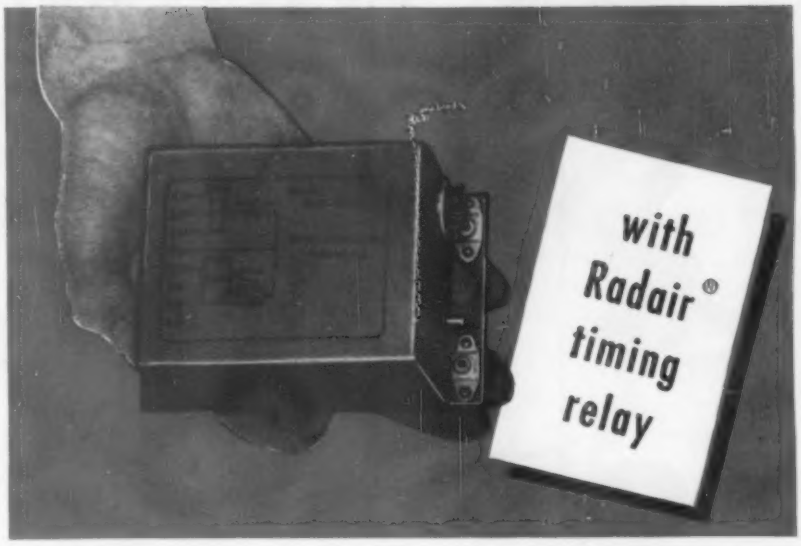
Previous YH-16 blade of stainless steel laminate weighs 7.24 lb./ft. and CG of the chord is 28.7%.

The firm has also finished initial test phase on an experimental blade of HUP size having a steel C-spar with foamed nose section and an aft section filled with honeycomb. Weight per foot is given as 2.81 lb., CG is at 26.1% of 13-in. chord.

A new concept in repairing Army helicopters was revealed at the booth of Ludwig Honold Manufacturing Co., Folcroft, Pa., which makes aluminum re-useable shipping container for aircraft and missile components.

Army is interested in packaging vul-

Electronic equipment back in action at "tube-reheating" speed



For aircraft and industrial applications

It's now possible to get electronic equipment back into service just as quickly as warm tubes reheat to *safe operating temperature* . . . instead of waiting the full time required to heat cold tubes. Quick-action Radair timing relay starts operation *minutes sooner* when tubes have not completely cooled from previous operation.

The Radair timing relay has a reset timed to the cooling rate of the tubes. It automatically recloses the plate circuit in the quickest time that will *insure full protection to the tubes* and other electronic components. In radar equipment, quick-action Radair is a vital safety factor. In transmitters and other industrial applications, it cuts lost operating time. Available for use on 115V, 400 cycle and 28V D.C. aircraft requirements. Send for FREE BULLETIN 815 containing a complete timing curve and full data on Radair.

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( ) Snap Fasteners (AN 227)

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nerable sections of its helicopters so that in the field, or even behind enemy lines, damaged units can be pulled off and replaced, saving time and facilities required to repair these sections.

Honold is developing three containers, one each for a complete tail unit, a rotor transmission and a powerplant for H-19, H-34 and H-37. The company has tested prototypes and is now negotiating production contracts.

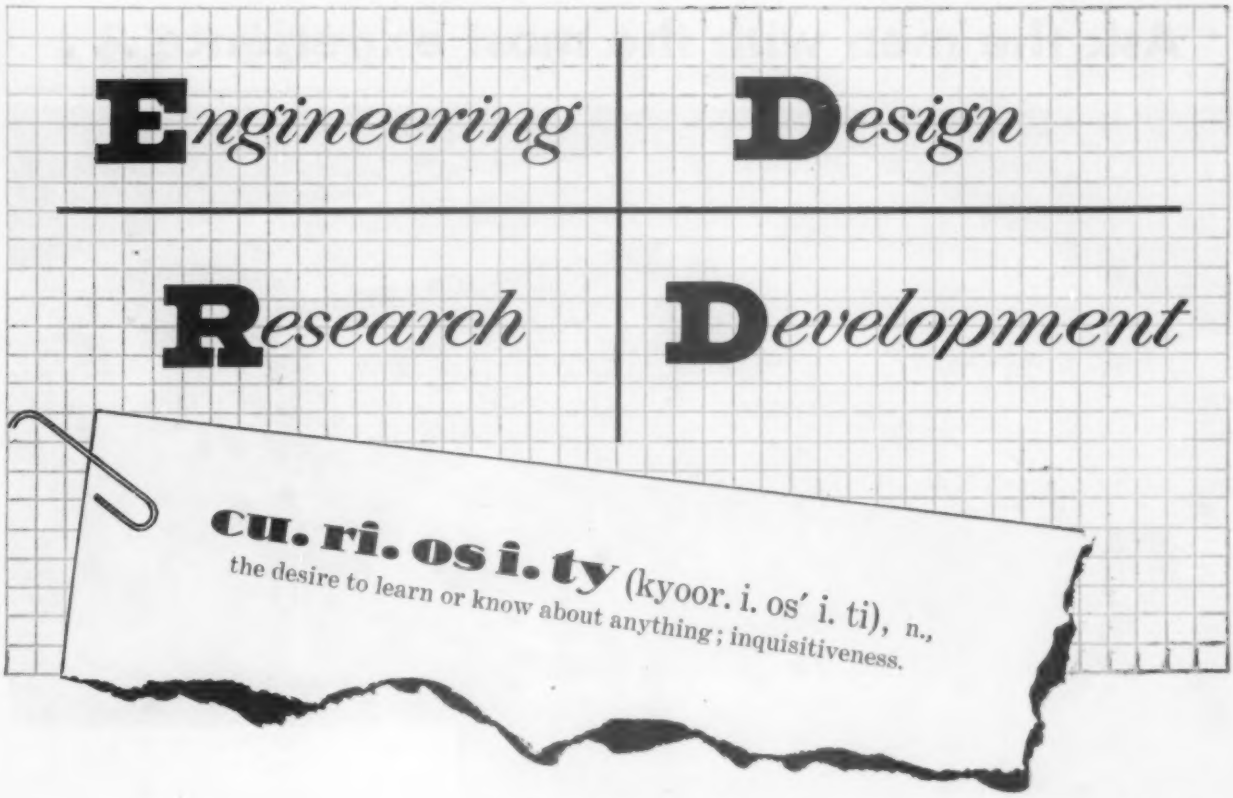
It is making containers to take a Fairchild Petrel missile head and the powerplant section, built to Naval Ordnance Experimental Unit specifications. The container weighs 298 lb., the shroud mounting the equipment weighs 28 lb. and the rubberized hair filler weighs 150 lb. Specifications included an unloading procedure during which one end of the container is tied to a tree and the truck is driven away from under it. Quick disconnect T-bolts permit two men to get the missile head out of the container in 2.5 min., AVIATION WEEK was told.

Miniature Axial Blower For Either A.C., D.C.

Miniature axial blowers for either a.c. or d.c. power are available with air flow in either direction and also for operation on frequencies other than 400 CPS.

The a.c. axial blowers are a combination of Type SC 400 or 60-cycle motor and a die-cast aluminum fan mounted in a die-cast aluminum housing. The d.c. blower uses Type SS motor and can be furnished with standard windings. They are made by Globe Industries, Inc., 1784 Stanley Ave., Dayton 4, Ohio.

TUMBLER RIG paints detail parts ten times faster, Glenn L. Martin Co., reports. Ten-gallon paint can with baffles, a detachable screen at one end and a small hole at the other end, is made to rotate in a fixture horizontally with the detail parts inside. During the tumbling process paint and air are sprayed alternately through the small hole. The complete cycle for painting hundreds of parts on an average load is approximately two minutes.


Engineering
Design
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Development
cu. ri. os i. ty (kyoor. i. os' i. ti), n.,
the desire to learn or know about anything; inquisitiveness.

This is, quite frankly, a bid for inquisitive engineers—creative men who desire to learn more about the future and what it may hold for them.

For at Goodyear Aircraft we have a policy of "progressive curiosity"—a continuous pioneering into new fields, new materials, new methods, new structures—and it has paid off in a host of new advancements important in the progress of missiles, jets, airships, helicopters, radar, plastics, metals and electronics.

It has paid off because this forceful, creative thinking has attracted engineers really *seeking* the challenge of new concepts.

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The fields are as broad as the challenge. Goodyear Aircraft is unique in its scope, rock-solid in its stability – contributing importantly in virtually every phase of aeronautics and related fields, backed by the resources of the world's largest rubber company.

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Mr. Jenkins, shown here with a Swift 125, has been flying as a crop-duster and student instructor for nearly 19 years.

ask **Joe C. Jenkins,**
crop-duster and
student instructor
Wyoming, Delaware

Mr. Jenkins says, "Quality aviation products are a *must* in my business, particularly with so much low altitude flying necessary for crop-dusting. I find that no other aviation oil, at any price, gives me the performance and protection of Gulf's top-quality oils.

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If your plane is powered with a horizontally opposed or Ranger in-line engine, your best bet is *Gulfpride Aviation Oil, Series-D.* It's a detergent dispersant oil that cuts down ring- and valve-sticking, high oil consumption, oil-screen clogging, and plug fouling. Pilots who use it say it stretches the time between overhauls as much as 100%.

To get best results with a radial engine, or one that doesn't need a detergent oil, use *Gulf Aviation Engine Oil—Series-R.* It retards sludge and carbon formation, and retains its body at high operation temperatures. Pratt & Whitney and other aircraft engine manufacturers approve it for all types of services in radial engines.

AND Gulf Aviation Gasoline . . . comes to you "refinery clean"—for your safety—from pumps with advanced *Micronic Filters.*

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LETTERS

Safety At Sea

In the Washington Roundup (Aviation Week, August 22) I'm glad to see that the issue of safety at sea for transatlantic aircraft is not forgotten among the Powers who Pull the Strings in Washington.

But the comment there that "no direct communication between the ship and aircraft is possible in most cases since the vessel lacks the necessary frequencies" is not really right. The vessels, the surface vessels, have the necessary frequencies. Several airlines, TWA and KLM for instance, except for some late modifications, have direct communication on the international distress frequency with any ocean-going vessel at all times.

It's too bad this precaution is not enforced by the CAB on all carriers who fly passengers over the North Atlantic. The Navy considers it wise to do a special job for the President—good for the Navy! But why shouldn't the thousands of ordinary passengers who daily fly the Atlantic at least have similar protection which is there already in the form of merchant vessels?

Keep up the good work, Aviation Week!
Arden Wootton, Vice Chairman
International Radio Air Safety Association
17-19, Avenue du General-Leclerc
Paris 14 E, France

Air Freight Safety

Development of the air freight industry is clearly an issue of long-standing interest to aviation in general and of special concern to several government agencies and air industry associations. (Your news item on page 7 of the July 18th issue suggests that Mr. Prescott of the Flying Tiger Line feels quite strongly on the matter!) It will be agreed, I'm sure, that encouragement of the air freight industry is a matter of major significance in our economy and important to our logistic strength in these times of cold and spasmodic brushfire warfare.

Several years ago, activities of the Aircraft Industries Association brought into clear relief a situation seeming not in keeping with the interests of maximum progress of air transport in this country. The situation: airworthiness requirements (CAR 4B), coupled with operational safety requirements, are rigidly though objectively directed to maintaining an acceptable level of safety in all phases of transport operations. The definition of "acceptable" safety and the units of measurement were, at that time at least, undetermined. The general view appeared to be that the higher the level of safety we could achieve—and still fly—the better. We won't debate this broad issue here, although it is probably still a sensitive one. On a less philosophical plane, we might take a hard look at certain relationships which then governed, or at least importantly influenced, the progress of the air freight industry. (The relationships apparently still exist, judging from Mr. Prescott's remarks.)

Assume we have a typical CAR 4B airplane involved in a normal freight operation —transcontinental, let's say. We immediately note certain startling contrasts with typical non-freight air transport operations:

1. No passengers (flight crew only, normally).

2. No compelling need to take off into poor weather (Though temptation may sometimes be great to keep the show on the road!).

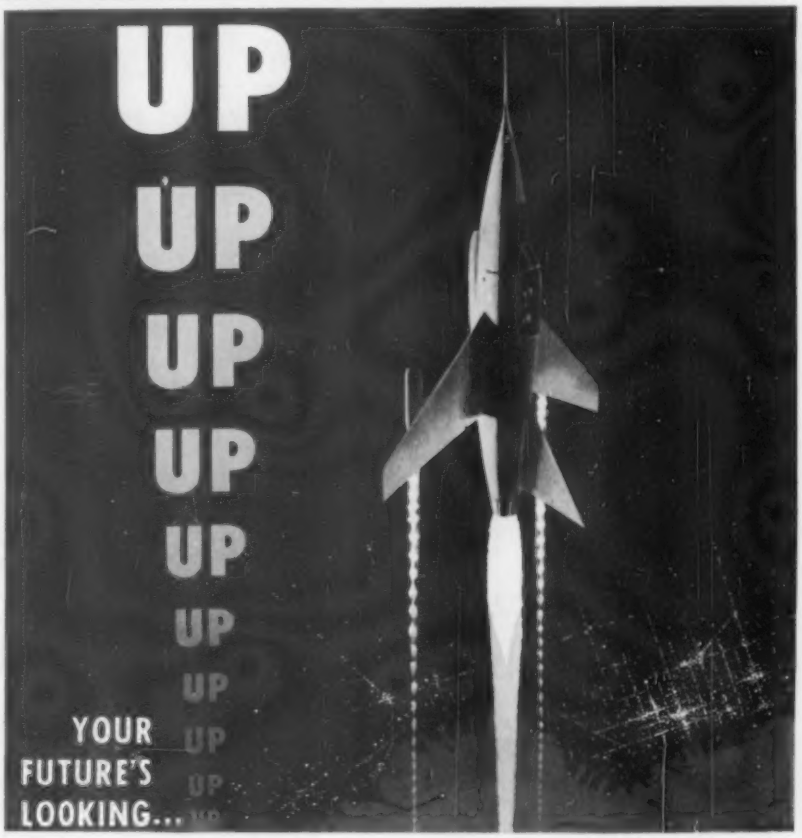
3. Little reason to accept any but optimum C. G. location on every flight—ideal for the specific airplant, that is, relative to stall characteristics, stability and control and performance.

4. Freedom to use JATO at the beginning of a long flight and to use advanced arresting devices at the end when conditions and economics indicate that this is desirable. (Assuming drogue 'chutes, for instance, could be approved by the CAA.)

5. Related to Item 1 above, complete freedom to give the flight crew parachutes. (If a bad fire breaks out, I'd bail out over open country!)

6. No compelling reason to risk life and property under any circumstances. (As a

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.



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passenger on a scheduled transcontinental nonstop flight recently, I was dropped through a hole in the alto-stratus and then tucked in under the zero-zero edge of sea-fog that had already reached the approach lights at Los Angeles International Airport —presumably so that we could all meet our loved ones on schedule—or maybe the pilot's wife was waiting. Damned foolishness, in any event!)

There are several other pertinent conditions which will be quickly recognized on unbiased scrutiny of this situation. Suffice to say, the actual level of safety in air freight operations seem significantly, and possibly inherently, higher than in passenger transport.

One can immediately draw a tentative conclusion that, assuming the above approach is basically correct, the allowable maximum gross weight for a specific air freight operation could be notably and progressively increased.

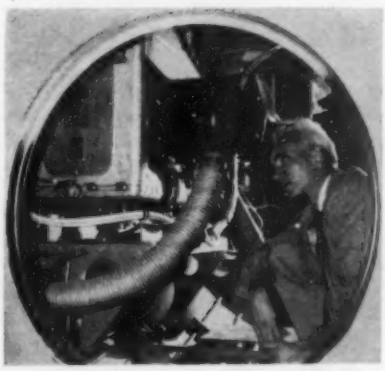
It is well established that the potential in air freight (ton-miles per year) increases dramatically with reduction of price per ton-mile. We have only to allow, for instance, a 10% increase in gross weight allowable for a given airplane and operation, and we net something like a 25% increase in payload (using nice round numbers, of course). Cost per ton-mile would plummet correspondingly and, if savings were assessed equitably to the consumer, your freight volume should show a whopping increase.

I don't wish to labor the point, but permit me one additional observation: If the CAB could be induced to alter the appropriate regulations in a few spots to permit somewhat increased gross weight allowables in air freight operations, the industry would very possibly realize the boost Mr. Prescott is yearning for. A very slight change in obstacle height (50 feet down to 40 feet, for instance) would be a clean start. All we need, really, is a start. Demonstrated trends, both in accident rate (a good, rather conclusive, measure of actual safety) and in expansion of air freight, would soon show what further steps were reasonable.

The American public—not just the air freight industry—should come out way ahead in this. Don't you agree that the idea should be reexamined by forward-looking groups like CAB? Even LPA might take an interest, in view of the possibility of generating more positions for pilots—especially in the very safe type of work found in air freight operations. Airplane manufacturers, through the AIA, should again feel their way into this, just as they had the opportunity to do at least once before about seven years ago. By the way, doesn't CAB operate under a mandate to advance the cause of civil aeronautics where the way ahead is found clear?

J. A. Varney
Coleman Engineering Company, Inc.
6040 West Jefferson Boulevard
Los Angeles 16, California

"MARS"® APU INSTALLED IN FIRST C-121C



Snug fit of Solar APU in tail of C-121C is examined by William H. Monson, Lockheed engineer. Newly designed Mars APU shroud provides improved accessibility, is shown in top photo.

SPECIFIED EQUIPMENT on the Air Force C-121C—military version of Lockheed's Super Constellation—is the Solar Mars gas turbine-powered auxiliary power unit. Snugly placed in the plane's tail, the compact, lightweight Mars unit provides instant power at the flick of a switch.

Heart of the Solar APU is the reliable, proven Mars gas turbine—recently uprated by the Air Force from 500 to 750 hours between overhauls. Similar basic units are being used on the Douglas C-124C and the Convair C-131B.

Descriptive folders covering aviation applications of both the 50 hp Mars and the 500 hp Jupiter gas turbines are available. Write today to Solar for more information about these history-making power plants, Dept. B-66, San Diego 12, Calif.

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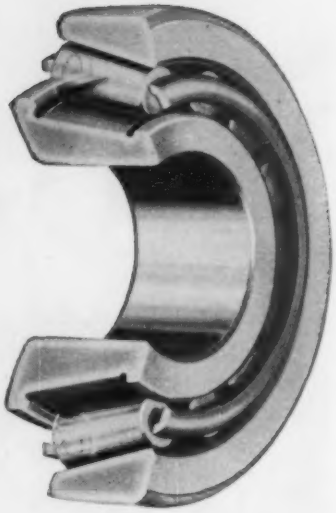

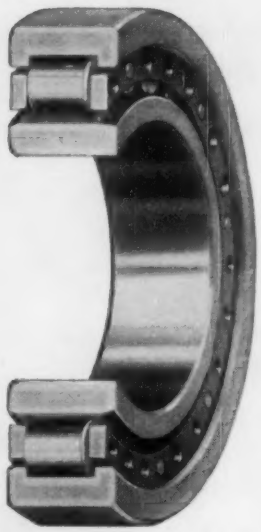

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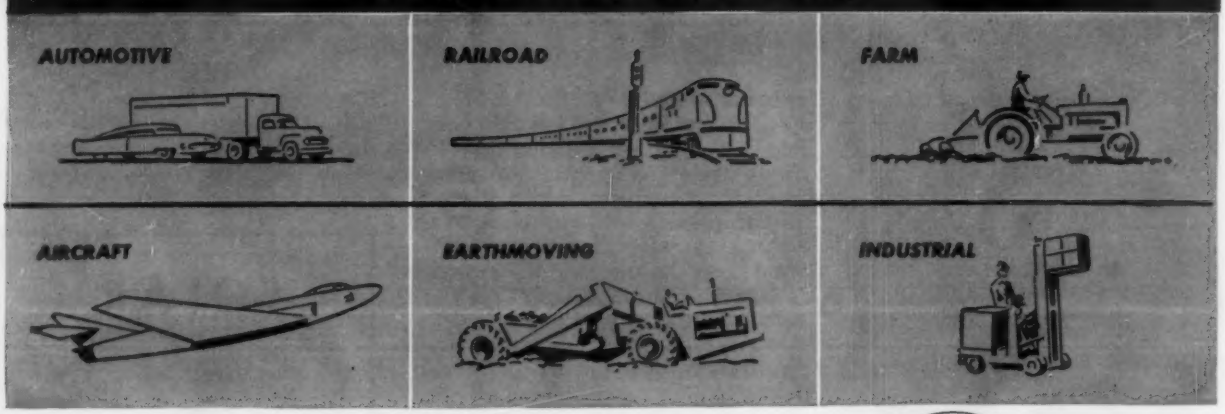

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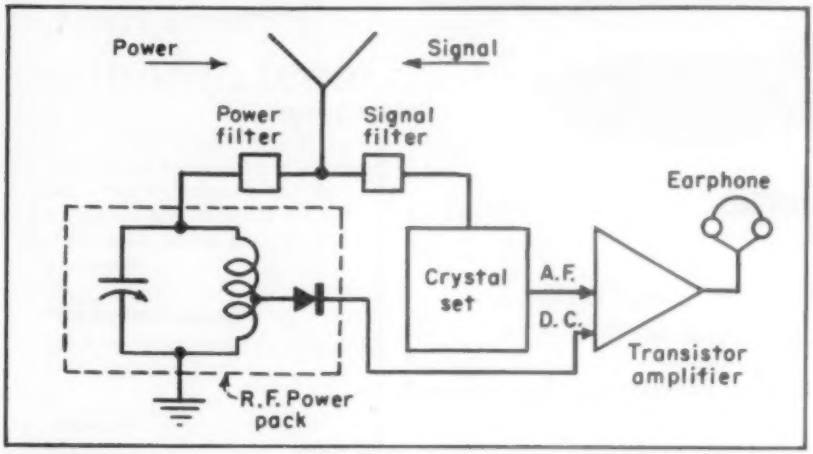


SCHEMATIC of "free power" radio receiver gets power from broadcast stations.

WESCON Hears First Report On Free Power Avionics Devices

By Philip J. Klass

San Francisco—Small transistor receivers and transmitters which require no batteries or solar cells and operate directly from "free power" radiated by broadcast stations were described by Hydro-Aire's Dr. Hans Hollmann during the recent Western Electronics Convention here.

The "free power" principle, made possible by the extremely low power required to operate transistors and first revealed in Aviation Week (May 2, p. 9.), opens up interesting applications. These include inexpensive receivers which could be sent by balloon behind the iron curtain, operated by radiated power from Russian stations, but tuned to receive Voice of America broadcasts. Other possibilities include low power rescue beacons and tiny walkie-talkies.

Among other papers were reports on:

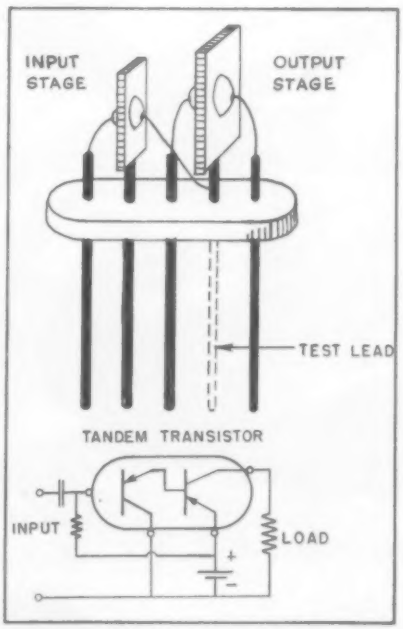
• **Progress toward formulas** which will enable electronic circuit designers to quantitatively predict how circuit parameters will affect vacuum tube life.

• **Willys flat cathode ray tube** principles of operation, with a limited explanation of how its electron beam deflection system operates. The new flat tube is slated for use in a novel cockpit display under development by the Navy. (AW Jan. 24, p. 19).

Free Power Principles

The junction transistor, with its ability to operate on one microwatt or less of power, has opened up the field of "free-power" devices. Using a modest size antenna, several milliwatts of power can be picked up at distances of several miles from a broadcast station transmitter. Even more power can be picked up at higher frequencies, or by beaming the RF energy.

Radiation from the local station which is to power the equipment is picked up by an antenna and passes through a filter tuned to its carrier frequency to what Hollmann calls an "RF Power Pack." This consists of a tunable L-C network, which can be resonated at the carrier frequency and a crystal diode to rectify the carrier power and remove its modulation. (See sketch.)



EXPERIMENTAL tandem transistor with two semi-conductor crystals in single shell.

The signal from another station, to which the receiver is to be tuned, comes in over the same antenna, passes through a tuned filter, and on to a suitable transistor receiver, powered by energy from the RF power pack. This receiver can take any of several forms:

• **Crystal set** with a transistor stage of audio amplification.

• **Regenerative-type receiver** (popular many years ago before the advent of the superhet).

• **Semi-passive superhetrodyne.**

In addition to these receivers and experimental free-power oscillators, Hollmann described a repeater or frequency converter station which converts an incoming RF signal to a new carrier frequency and rebroadcasts it at very low power.

Hollmann revealed that Hydro-Aire had developed experimental "tandem transistors" in connection with its work in free-power devices. These consist of two semi-conductor crystals housed in a single container. The two are directly connected, one grounded collector, the other grounded emitter, so that the input transistor forms the base lead of the output stage. (See sketch below.)

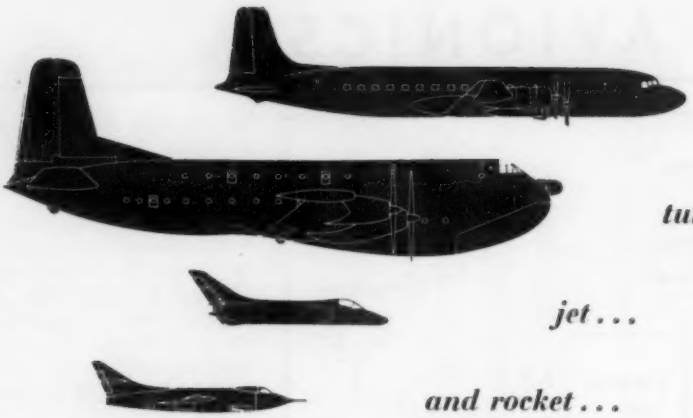
In free-power oscillators, where available power is extremely low, greater frequency stability can be achieved with the new tandem transistor by eliminating external connections required with two normal single-stage transistors, Hollmann says.

Predicting Tube Life

Preliminary results from the first extensive controlled tests to determine quantitatively exactly how different operating conditions effect the failure rate of vacuum tubes were reported by W. S. Bowie of General Electric. For example, it appears that tube failure rate goes up with the seventh power of heater voltage, while transconductance goes down as the fourth or fifth power of heater voltage, Bowie reported.

Under Signal Corps sponsorship, GE is running controlled tests on 32,000 tubes, of four different types (5654, 5726, 6J6W, and 6005) to determine how tube transconductance and life is affected by heater voltage, heater cycling, plate voltage, plate current and plate dissipation (wattage), pulse operation, vibration and shock and ambient temperature. Each of these parameters is systematically varied to determine its effect on tube performance and life.

For each test, a lot of 200 tubes,



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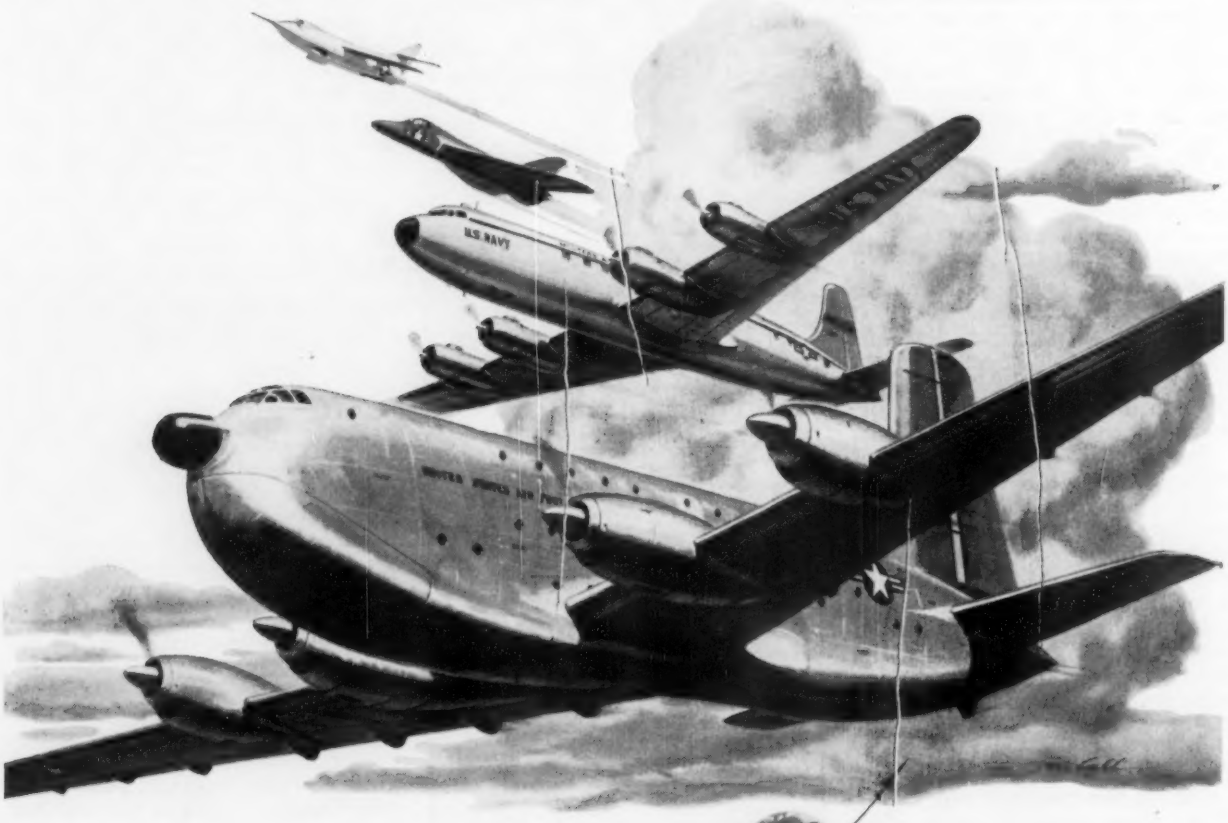

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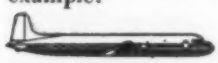

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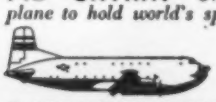

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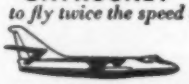

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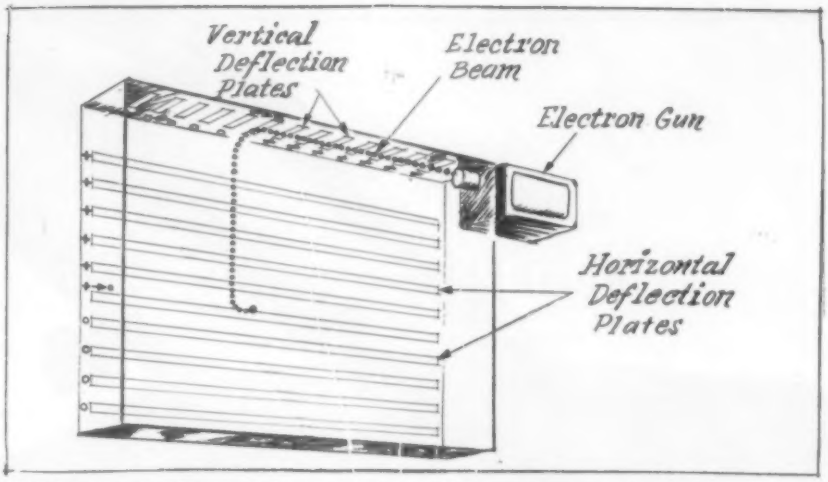

WILLYS flat tube showing voltage potential applied to deflection plates.

made up of units purchased from several manufacturers, is used in life tests which run for 5,000 hours. Tube characteristics are measured 14 times during the tests, so that a total of six million readings must be made during the program. When the project is completed in another year, the results will be reduced to 8,600 curves, which in turn will be reduced to emperical formulas for use by circuit designers.

The preliminary information released by Bowie was based on a trial run batch of 5670 tubes which GE used to prove out its procedures. Because lot size was only 50 tubes (instead of 200 used in the main tests), Bowie cautioned that the results might not be statistically conclusive.

Survival rate for the 5670s was markedly effected by the applied heater voltage. For example, after 5,000 hours of operation:

- 98% survived at 80% rated heater voltage.
- 89% survived at 90% rated heater voltage.
- 75% survived at 100% rated voltage.
- 28% survived at 110% rated voltage.
- 20% survived at 120% rated voltage.

Tubes operated at higher heater voltage naturally had a higher transconductance at the start, but it fell off more rapidly with use. In fact, after 1,500 hours, the tubes operated at 80% rated heater voltage had the highest G_m, Bowie indicated.

However, he warned designers to approach low heater voltage operation with caution. Emission falls off rapidly at lower voltages once the knee in the curve is reached, and the point might be different for other types of tubes. If tubes are operated at reduced heater voltage, very close control of such voltage is required. (This makes such a policy hazardous in aircraft where voltage can vary over wide limits.)

Ambient temperature has relatively little effect on G_m of 5670s during the first 2,000 hours, but failure rate goes up rapidly with higher temperatures, Bowie reported. For example, tubes operated at bulb temperatures of 185C had a 90% survival rate after 2,000 hours, but when bulb temperature was 260C, the survival rate was only 58%.

Failure rate of the 5670s under shock showed some tendency to run higher when there was no heater voltage applied, but the reverse appeared to be true under high frequency vibration. Bowie said he had no explanation for this phenomenon.

Under pulse operation, plate dissipation (watts) rather than peak plate current had the more marked effect on tube life. For example, when the 5670s dissipated 0.5 watt under pulse operation, 98% survived for 5,000 hours, but only 42% survived when dissipation was increased to 1.67 watts, Bowie reported. Bowie concluded that a tube's wattage rating must not be exceeded even under pulse conditions.

Willys Flat Tube

A large audience turned up to hear the first public discussion of the principles of operation of the radically new Willys flat cathode ray tube, given by its inventor, Ross Aiken. (A second paper, by R. Madey, scheduled to discuss the tube's beam focusing and deflection system, was withdrawn for reasons of competitive secrecy.)

Aiken reported that flat tubes, measuring two or three inches thick, with screen size equivalent to a conventional 24-inch TV tube, have been operated at resolutions up to 2,000 lines. Aiken said that the tube is "extremely stable and has little distortion." The Willys flat tube also gives an extremely bright display, without blow-up or loss of resolution, because of the inherent beam focusing action in the tube.

The electron beam generated by a

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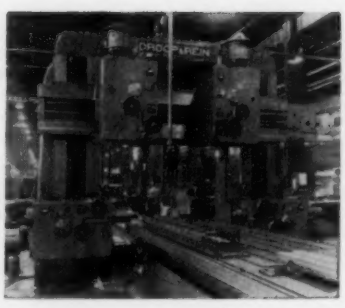
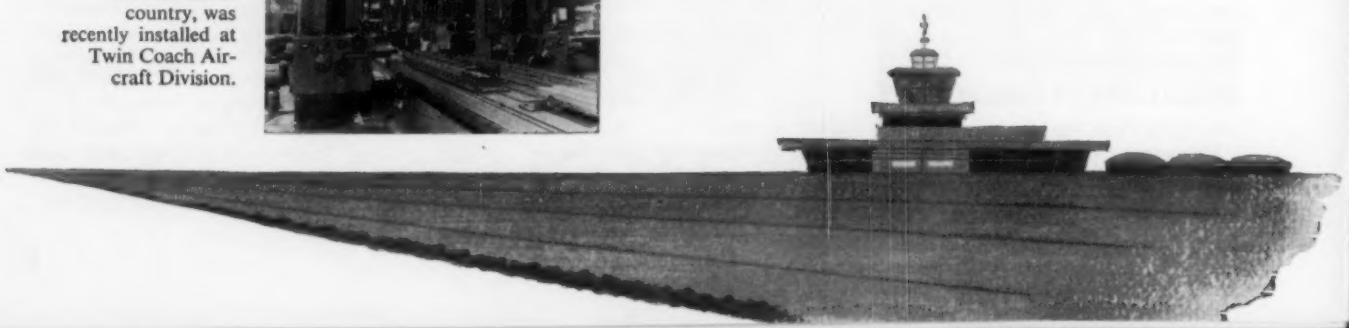


Giant 25-foot Droop & Rein universal planer mill, only one of its kind in the country, was recently installed at Twin Coach Aircraft Division.



conventional CRT gun is injected at the lower or upper edge of the tube, where it passes over a series of seven to 12 vertical deflection plates, placed horizontally along one edge of the tube. (See sketch, p. 97). These vertical deflection plates operate at potentials less than 1,000 volts.

By varying the potential on these plates, the beam is caused to deflect in a vertical direction, making a bend of nearly 90 degrees, and sweeping across the face of the tube in a horizontal direction.

At any instant, the deflection plates between the position of the beam and the electron gun are at a positive potential, thereby accelerating the beam. Plates on the other side of the beam are at zero potential.

The deflection plate opposite the point where the beam is being bent is at a potential which is varying from positive to zero.

When this deflection plate reaches or approaches zero potential, the potential on the next plate closer to the electron gun starts to sweep from positive toward zero, and so on.

The horizontal deflection plates, located along the back face of the tube, function in a similar manner, except that they operate at voltages of 10 to 15 kv. As the electron beam is deflected vertically into the control region of these horizontal deflection plates, the higher potential creates an electrostatic field which tends to refocus the beam, to reduce its diameter and avoid "splatter," Aiken said.

The Willys tube requires external circuitry to control and synchronize the sweep of potential on individual deflection plates.

Aiken indicated that Willys was developing special sweep tubes to perform this control function, in order to simplify external circuitry.

Aiken declined to say when the tube might be available in production, but expressed optimism that it would be priced competitively with conventional TV tubes. Although Aiken declined to discuss Willys developments in adapting the flat tube to color display, a spokesman for Hoffman Electronics indicates that his firm is working with Willys on such a program.

Kit Modifies ADF Sets

A new modification kit, designed to improve reliability of ADF receivers by replacing original rubber shock mounts with new all-metal ones, is now available from Robinson Aviation Inc., Teterboro, N. J. Civil Aeronautics Administration has issued a Radio Modification Data Sheet listing various types of ADFs which can use the new mounts.

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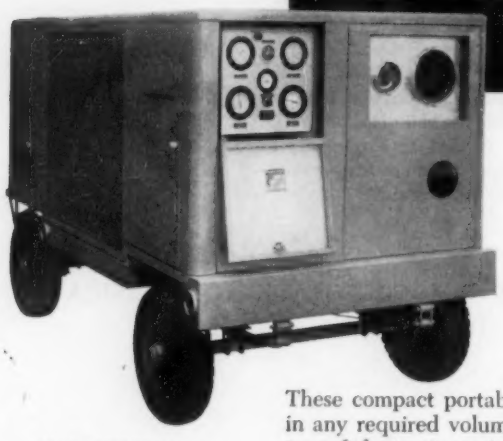

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Hydro-Aire Bows Out Of Semiconductors

Mar Vista Electronics Company, a newly-formed West Coast firm, has entered the semiconductor field with the purchase of Hydro-Aire's manufacturing equipment, designs and current developments.

The new firm, headed by Reagan C. Stunkel, will concentrate on the new "bonded barrier" high frequency transistors, developed by Hydro-Aire and will market its various semiconductor devices under the trade name of "Marvelco."

Homer H. Rhoads, Hydro-Aire's president, says the move will free his company to concentrate on the development of new avionic equipment employing semiconductors and on its regular line of aviation accessories and components.

It is no secret in the industry that the semiconductor field has become intensely competitive, a factor which recently caused Radio Receptor Co. to withdraw from the field and which may have been a factor in Hydro-Aire's move.

Other recent expansions and changes in the avionics industry include:

• **General Components Co.** is name of newly formed division of Washington Machine & Tool Works, Inc., Minneapolis which will develop and make avionic components and equipment. New division will be headed by I. C. Pedersen and Karl Schurr. Precision rotary and linear pots will be among the new division's first products to be marketed.

• **International Telephone & Telegraph Co.** will construct a new lab and manufacturing facility in Los Angeles for its Federal Telephone & Radio subsidiary to better serve the aircraft industry. Initial construction will occupy 36,000 sq. ft.

• **Stromberg-Carlson** recently acquired division of General Dynamics, will take over the Charactron project of the firm's Convair division which makes special display tubes for radar use. The Charactron operation will continue in San Diego. Stromberg-Carlson also has acquired the former Electronic Control Systems, Inc., Los Angeles, in which it was a part owner. The firm specializes in computers and data handling systems.

• **Varian Associates,** Palo Alto, Calif., maker of klystrons, has started construction on a 25,000 sq. ft. addition to its present facility which will bring the Palo Alto plant area to 63,000 sq. ft. Firm also occupies 50,000 sq. ft. of manufacturing facility in nearby San Carlos.

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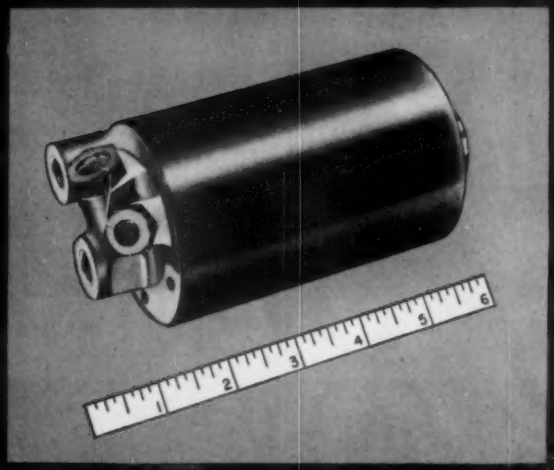

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▶ **Transistorized Fire Control System**—Emerson Electric has proposed a radar-directed tail turret system for a new bomber in which 85% of the tubes will be replaced with transistors. Transistorization is expected to cut system power consumption by 30%, reduce cooling air requirements by 25%.

▶ **Smaller Airline Avionics**—Collins Radio is developing new ½ ATR rack size versions of its glide slope, marker beacon receivers, and isolation amplifiers which now occupy ½ ATRs. New units will use transistors in some sockets.

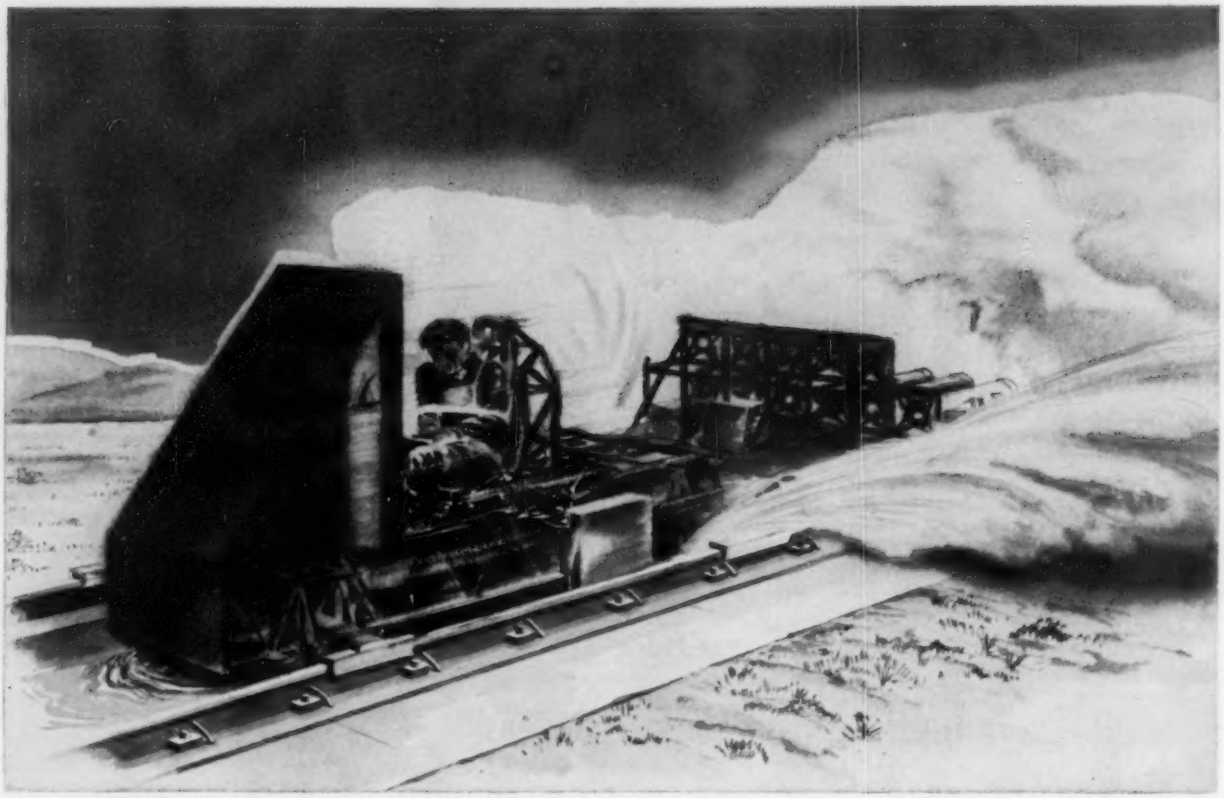
▶ **Quadradar Sales Booming**—Gilfillan now has orders for more than 30 of its low-cost Quadradars (surveillance, heightfinder, GCA, and airport surveillance), a company official says. About half of these are slated for civilian airports, most of them overseas, the official says.

▶ **New Drift Computer**—McDonnell Aircraft Co. has developed a new lightweight drift computer which automatically determines wind direction and velocity, for input to ground-position indicators such as the AN/ASN-6. MAC developed the new 30 lb. computer, which derives its information from an interceptor fire control radar, to eliminate the need for adding a separate 300 lb. surveillance radar to its F-100A. Several avionics firms are bidding to get the manufacturing rights to the device.

▶ **New Navy CNI Package**—Navy airframe manufacturers now are getting systems responsibility for procuring and packaging communications, navigation, and IFF (CNI) equipment to fit the configuration of their individual airframes. The new policy permits aircraft makers to integrate standard Navy approved CNI equipment to eliminate duplicate power supplies and other redundant elements.

▶ **Tough Klystron**—A reflex klystron made by Varian Associates, recovered after the landing impact from a record-breaking 158 mile high flight in a Viking rocket, was found to be in operating condition, according to a report issued by Naval Research Lab.

▶ **New Generator Test Stand**—A new device for testing a.c. and d.c. aircraft generators, under simulated flight conditions (take-off, cruise, combat, and landing) has gone into service at North American Aviation. The test stand was developed and built by Westinghouse Electric Corp.



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- ARCHITECT-ENGINEER SERVICES FOR TEST FACILITIES

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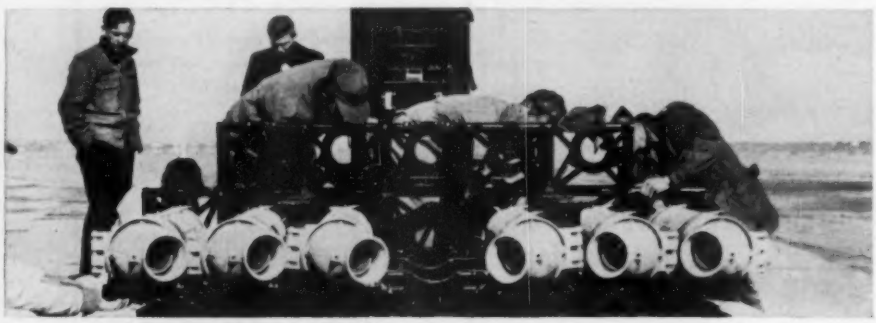
Electronic Engineers
Mechanical Engineers
Physicists and
Aeronautical Engineers

The high degree of safety and reliability of Aerojet-General solid-propellant rocket powerplants has been demonstrated by their repeated use on manned test sleds. Shown here is the Northrop sled which received widespread attention during deceleration tests conducted at Holloman Air Development Center, with Lt. Col. John P. Stapp, USAF, subjecting himself to deceleration rates up to 35 G's!

Power for the sled comes from six 5KS-4500 Aerojet-General JATOs, providing 4500 pounds thrust each for five seconds. Actually developed and produced for assisted-takeoff of heavy carrier-based aircraft, the use of the 5KS-4500 on the Northrop sled typifies the variety of applications for which the many existing types of Aerojet-General JATOs may be used.



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MORE POWER FOR AIR POWER

NEW AERO COMMANDER is aimed at executive demand for fast, high-flying transport.

Supercharged Aero Commander Features Top Speed of 260 Mph.

By Erwin J. Bulban

Philadelphia—The Aero Design & Engineering Corp. hopes to corner the lead in the twin-engine business-plane field early next year with a new aircraft and a new engineering concept.

The aircraft is the Super Aero Commander 680, a 260-mph. younger brother of the Aero Commander. The engineering concept should, the company says, speed the introduction of design advances into the production line.

The concept seeks to quickly narrow the wide gap now existing in the comparative performance of business and airline planes, company spokesmen told AVIATION WEEK.

The Super Aero Commander 680 has the company's word that it is the fastest twin-engine airplane ever designed and produced exclusively for business use. First deliveries are scheduled for February.

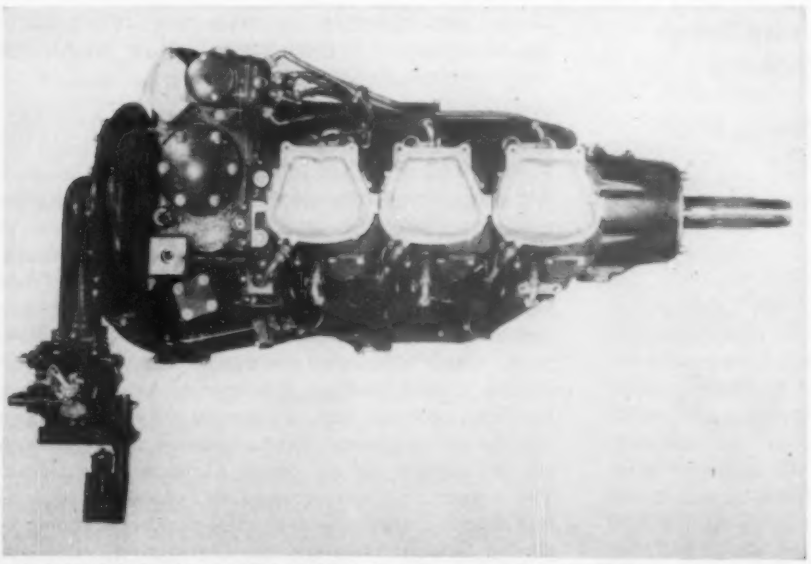
The 680-Super, which will sell initially for $84,500, will cruise at 230 mph. at 10,000 ft. on 70% power and will maintain a single-engine ceiling of 15,000 ft. fully loaded.

The key to this performance is the pair of Lycoming GSO-480-A1A supercharged engines, each developing 340 hp. on takeoff and 320 hp. normal rated continuous.

The Super Aero Commander is said to be the first business plane to be fitted with these power plants. The engine is a geared-drive six-cylinder horizontally-opposed dry-sump air-cooled unit with side mounted accessories. The supercharging feature materially improves engine performance because of a better fuel/ir mixture resulting in a higher degree of power distribution between cylinders.

Gross weight is 7,000 lb. and disposable load is 2,750 lb. Fuel capacity is 230 gal., enough for a normal range of 1,400 mi. and a maximum range of 1,700 mi.

Other specifications include: Two-engine rate of climb, 1,600 fpm.; single-engine climb, 425 fpm.; ceiling, 26,000 ft.



SUPERCHARGED LYCOMING ENGINE is key to Aero Commander's 260-mph. performance.

Internal Changes

Externally, the 680-Super resembles its predecessor, the 270-hp. Lycoming-powered 560-A. But the airplane incorporates numerous internal changes to take the increased horsepower and weight. The area of the wing spar caps and longitudinal members have been increased about 20% over the 560-A, and the skin gage in the wing inboard section has been increased some 15%.

The material in the wing main members is 14ST, as compared with the 560-A's 24ST, providing an allowable compression approximately 30% higher.

A revised main landing gear includes Goodyear 8.50 x 10 tires and 24 x 7.7 wheels with three-spot brakes, all larger units than used on the 560-A. The nose landing gear is the same as on the previous model.

Scott aviation equipment has been made standard equipment on the 680-Super because of its high-altitude capabilities. The Aero Design party flew from the company's Bethany, Okla., plant to Philadelphia on a trial flight at approximately 14,000 ft. Average ground speed for the Dayton-Philadelphia leg was about 240 mph.

Introduction of the new model is not expected to have any early effect on 560-A production, the company said. Some customers will not require the new airplane's long range and high-altitude performance so Aero Design will produce the 560-A so long as a demand exists.

More efficient use of Aero Design engineering hours has resulted from the location of the engineering department in Norman, Okla., about 25 mi. from the production plant, Vice President T. R. Smith told Aviation Week.

The Norman engineering unit has a working force of 30, its own airplanes, experimental shops capable of building an entire plane and flight test facilities. Not interrupted by day-to-day production plant problems, the engineers can devote more time to research and then grind suitable modifications into the experimental airplanes at a faster rate than would be possible at the home plant.

An example of the independent work done by this group was the sweeping of the tail on the 560-A. The jump to more powerful engines and higher gross weight over the previous 520 model at first indicated that the

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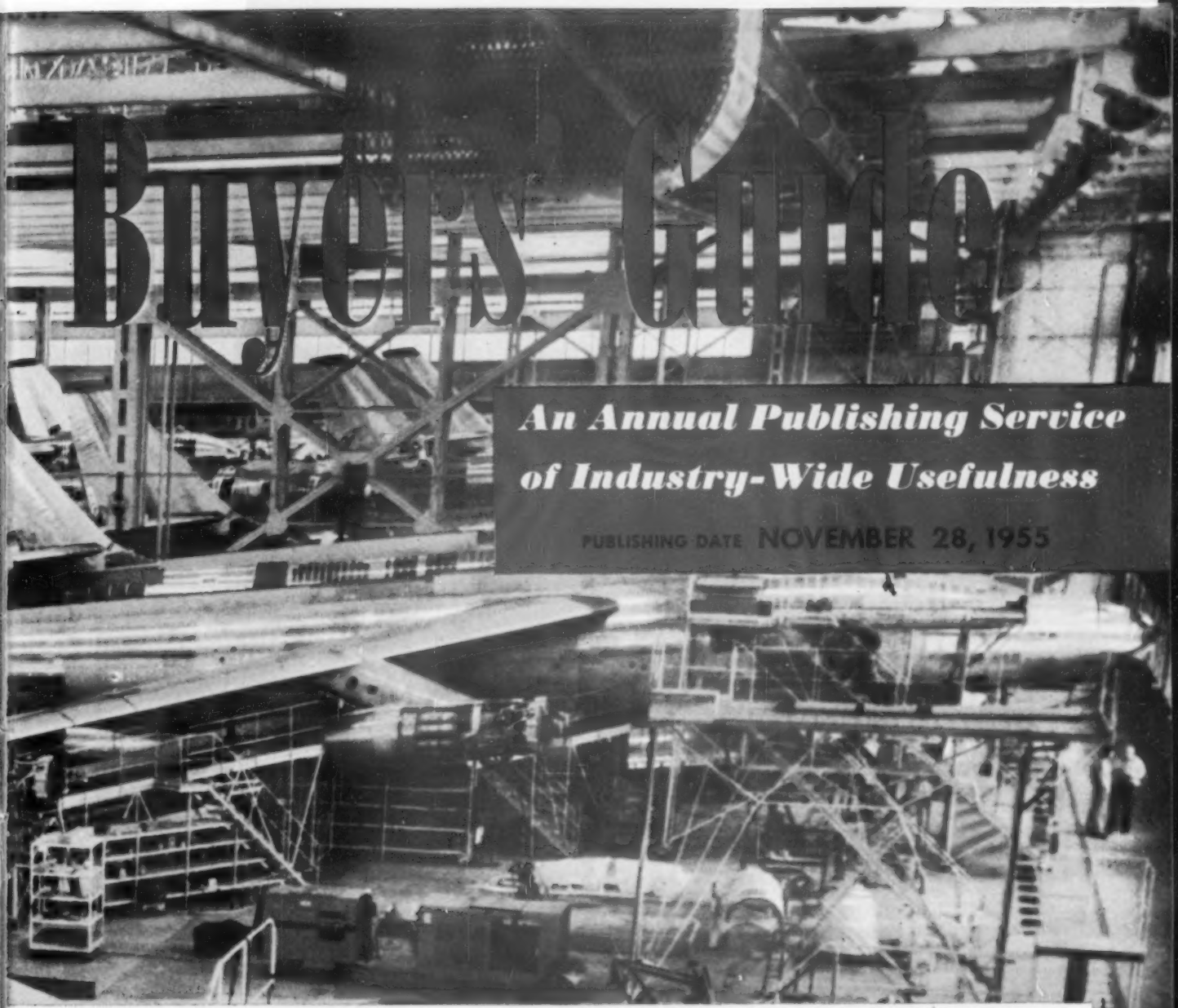
The latest developments in military procurement will be covered in a special report. Included in the detailed information to be presented will be: Air Material Command—Air Research and Development Command buying practices, personnel listings—by name, procurement centers, etc.; All-inclusive listings of manufacturers of aeronautical and allied products, sectionalized for maximum utility under six major headings: **Aircraft;** Airframe and components, Armament, Fixed Equipment, Landing Gear, Powerplant. **Missiles;** Airframe and components, Equipment, including ground-handling, Powerplant. **Avionics;** Communications systems and equipment, Radar-fire control systems and equipment, Instrumentation and controls, Navigation systems and equipment, Components and devices, Test equipment, Computers and data processing equipment in airborne, ground-based or shipboard applications. **Supporting Groups;** Data systems, Electrical, Ground equip-



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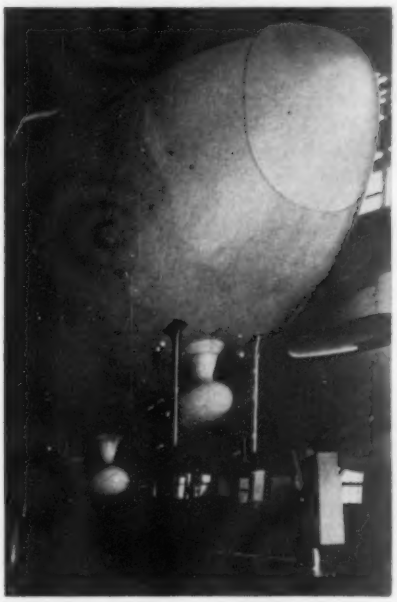
next model would require a 1.5-ft. longer fuselage or else about six square-feet more tail area. Norman calaculated that sweeping the tail back by 15 deg. would make it unnecessary to make either of the major changes, which would have meant expensive production re-tooling. The modification was built and test-flown on Norman's 520 "dog ship" and flight tested at the installation. Results were incorporated at Bethany's production line. The modified 520 also served as the test-bed for the 680-Super modifications.

Among the engineering unit's important current assignments is development of an airline-type flight manual for the new 680-Super. Covering every possible condition that might arise in the operation of the airplane, it will be the most complete work in this field, Smith said. Data for the manual is now about 75% complete, and the reference should be ready to go with airplanes when they leave the factory.



Thin-walled Radome

This new thin-walled radome installed on the nose of a Lodestar, is suitable for use with either X- or C-band airborne radar (AW July 25, p. 34) and has just been put on the market by Chamberlin Aviation Corp. Radome is made from multiple ply fibrous glass cloth and is vacuum-molded with approved types of resin. This method of forming results in a structure which holds close tolerances and all cross sections and is completely free of bubbles and voids. Tensile and impact strength is very high, according to the manufacturer. Radome is hinged to the fuselage, allowing quick, easy access to the radar compartment. Special lock secures dome in closed position. Units are currently available for DC-3s and Lodestars; others will be available soon. Address: Akron Municipal Airport, Akron, O.

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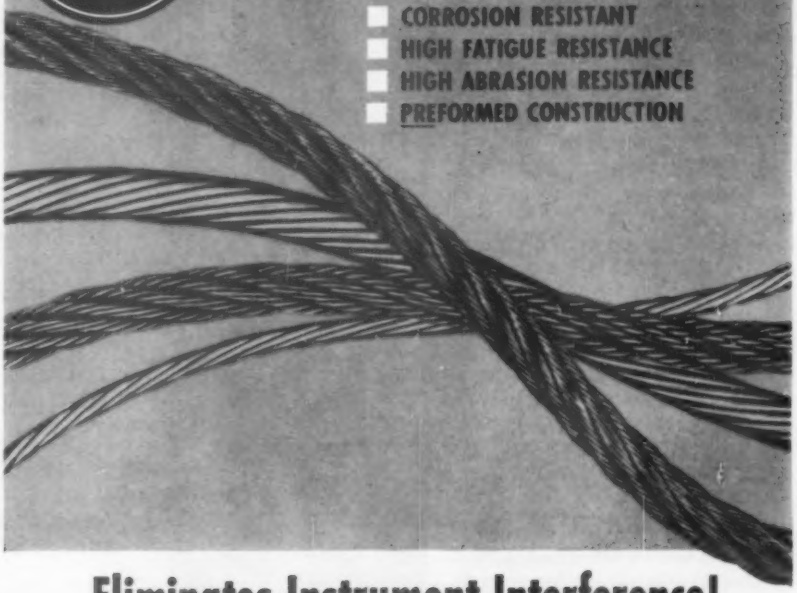

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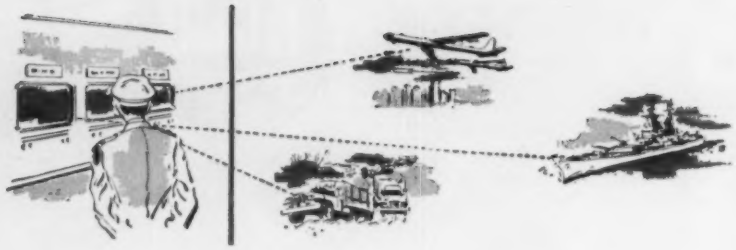

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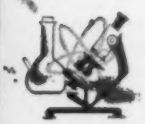

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Rubber engineering data book describes molded and extruded rubber products, Tyer Rubber Co., Industrial Div., Dept. P, Andover, Mass. . . . **Magnetic Null Indicator,** bulletin, Doelcan, Div. of Minneapolis-Honeywell Regulator Co., 1400 Soldiers Field Rd., Boston 35, Mass. . . . **Kenco punch presses,** folder, Kenco Manufacturing Co., 5211 Telegraph Road, Los Angeles 22, Calif.

"The Prevention of Occupational Skin Diseases", booklet, Association of American Soap & Glycerine Producers, Inc., 295 Madison Ave., New York 17, N. Y. . . . **Tru-Loc fittings and wire rope assemblies,** Catalog TL 500, American Chain & Cable Co., Inc., Wilkes-Barre, Pa. . . . **"Buyers Guide to the Complete Line of All-State Alloys and Fluxes",** booklet, All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y.

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Inner-Fin, heat transfer substance, brochure, Bush Manufacturing Co., West Hartford, Conn. . . . "How to Get More Accuracy", data sheet and catalog on **expanding method for holding parts** while machining, gaging and checking, Charles J. Martin & Sons, 34136 Myrtle St., P. O. Box 710, Wayne, Mich. . . . "AM 350, a **Chromium-Nickel-Molybdenum Stainless Steel** Hardenable by Subzero Cooling or Double Aging," booklet, Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa.

"Design with Microcast in Mind," brochure on **investment casting,** Microcast Div., 224 E. 39 St., New York 16, N. Y. . . . Series 4000 line of **slide-type sequence valves** for 3000 psi hydraulic service, data sheet, Aircraft Products Co., 300 Church Road, Bridgeport, Pa. . . . **Six-inch strip-chart recorders** for pressure, liquid level, temperature, flow and mechanical motion, bulletin, The Bristol Co., Waterbury 20, Conn.

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North American Aviation, for many years the country's foremost designer and builder of military aircraft, has an established engineering team at the Columbus Division with prime responsibility for the design and development of Navy aircraft.

The Navy's latest "Fury" Jet . . . the FJ-4 . . . is one of the accomplishments of this skilled engineering team. Many other designs for new, high-performance, super-sonic aircraft are being developed from initial concept to flight by North American's Columbus Division.

This fully integrated group of engineers must be further expanded to meet our growing demands. These new projects offer many outstanding opportunities to all types of engineers involving the full complement of skills . . . from basic research to flight test.

IMMEDIATE OPENINGS FOR: Aerodynamicists, Thermodynamicists, Dynamacists, Stress Engineers, Structural Test Engineers, Flight Test Engineers, Mechanical and Structural Designers, Electrical and Electronic Engineers, Wind Tunnel Model Designers and Builders, Power Plant Engineers, Research and Development Engineers, Weights Engineers and many others. Write or wire today for more information: Engineering Personnel, Department 56A, Columbus 16, Ohio.

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COLUMBUS DIVISION

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DECCA is an extremely accurate *visual* navigator system. Every movement of the craft is instantly traced on the Flight Log. This is an actual terrain map on which the pen traces your exact course. You see exactly where you *are* and you fly—*in any weather*—a safe, positive course.

Decca is a *low frequency* navigation system operating from a chain of master and slave stations located in a star pattern and covering an area of some 200,000 square miles. Unlike high frequency line-of-sight transmission, Decca provides low-flying helicopters with position-fixing accuracy *down to ground level—even behind hills.*

Decca makes helicopter navigation as simple as following an automobile road map. Write us today for the complete story.

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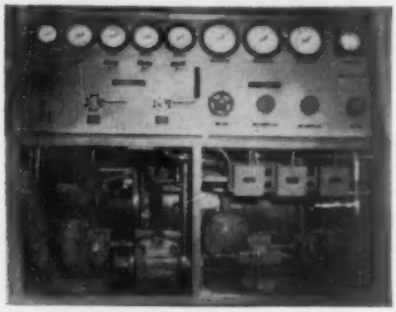
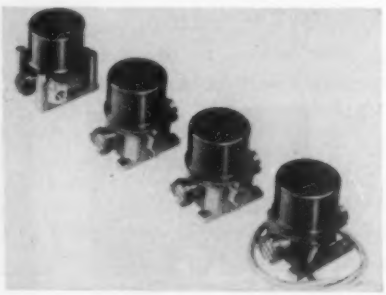


Helium Compressor for Missiles

Multiple stage hydraulic booster-compressor for larger quantities of clean high-pressure helium gas to be used in guided missiles can operate without lubrication when necessary. Gas obtained from commercial bottles at pressures of 2,000 psi. can be boosted to higher pressures.

The booster is self-regulating for maximum output at any inlet pressure within its range.

Haskel Engineering and Supply Co., Glendale, Calif.



Servo Valves for 500-3,000 Psi.

Electrically-actuated high-response hydraulic servo vales for 500 to 3,000-psi. hydraulic systems have a controlled maximum output up to 9 gpm. with a time constant of approximately 1.5 milliseconds from input differential current to output flow.

Weighing less than a pound, the valves incorporate a floating armature located above two vertically placed nozzles.

The manufacturer reports that only the torque output of the motor restricts the motion away from one nozzle, so that the motor receives a high natural frequency. The shuttle fitting to the sleeve is said to be within millionths of an inch of the ideal clearance.

Required torque output and full hydraulic flow is obtained with differential currents of 8 ma. maximum.

Pacific Division, Bendix Aviation Corp., N. Hollywood, Calif.

Unit Reconditions Spark Plugs

Aircraft spark plug reconditioning unit is said to be able to service 500 plugs in eight hours.

Equipment, with eight different stations on it, can be used for cleaning spark-plug threads or the lower and upper insulator, or setting the electrode gap, testing gas leakage and insulator and wire resistance, and for greasing threads. Resistance check circuit uses high voltage current for value of center wire resistance.

AC Spark Plug Division, General Motors, Flint 2, Mich.

Switch for Exposed Uses

Sealed cylindrical switch, model 1EN1-6, for exposed aircraft applications, has two single-pole, double-throw switching units within its can-shaped metal housing. Inert gas under pressure in the housing is said to insure constant operating characteristics.

Six 6-ft. leads project at 90 deg. from base of the switch making it possible to make connections in any direction by rotating the unit. Operating force is approximately 9 lb.

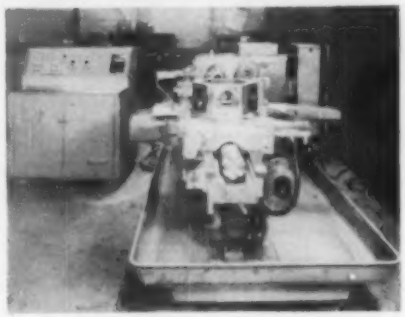
Micro Switch, Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill.

Turns Radius up to 4 in.

Radius turning attachment, actuated by a worm and worm gear to give maximum control in generating spherical surfaces, has a capacity of 0 to 4 in., allowing the radius to be pre-set to a finished diameter.

Attachment is supplied with two holders; one tool holder turns annular grooves or collars, the other turns spherical surfaces on the end of the bar.

Wade Tool Co., Waltham, Mass.

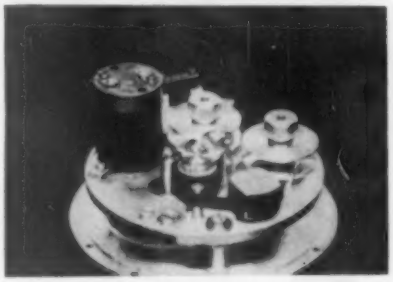


Tape Controls Machines

Binotrol punch tape control system for automatic operation of machine tools and valves, uses digital-to-analog principle. System has few vacuum tubes since circuitry is composed of telephone-type relays.

There are 32 possible hole positions, permitting completely automatic starts, stops and re-cycling.

Barnes Engineering Co., Stamford, Conn.



Recording Unit Measures 60G

This Glennite Model KAT-1 tape-recording accelerometer system measures acceleration up to plus or minus 60G in guided missiles or for air, land and sea vehicles without use of direct cable or wireless connections.

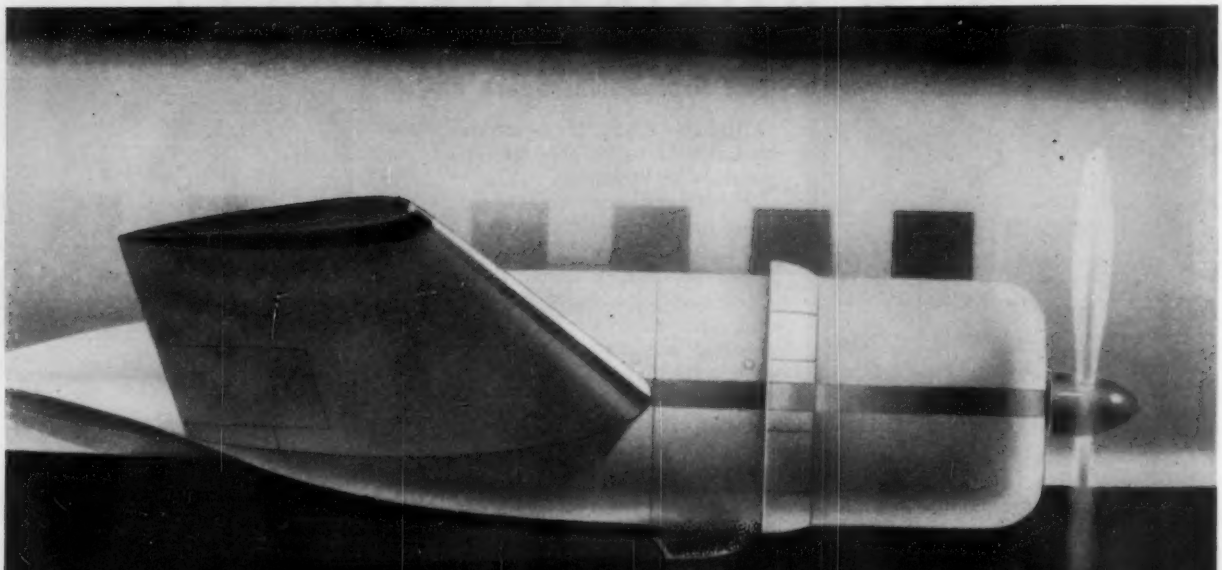
The unit provides instantaneous 30-sec. permanent tape recording of vibration and shock acceleration in moving devices. Self-contained, self-recording accelerometer contains a miniaturized electronic circuit and can withstand shocks up to ±80G.

Gulton Mfg. Corp., Metuchen, N. J.

Switch Avoids Overloads

Syncro-Snap under-speed centrifugal control switch avoids overloading as well as belt slippage and breakage by stopping operations of a unit at a predetermined minimum speed. While operating at normal speeds, the rotary section does not touch switch.

Torq Engineered Products, Inc., Interstate St., Bedford, Ohio.



Eliminate the fire hazard of flammable hydraulic fluid

Flammable aircraft hydraulic fluids are one of the major causes of fire in flight. Should a hydraulic system leak, sparks, friction-heated metal, even a normally operating exhaust manifold, can ignite them! Prevent this danger by converting to Skydrol—world's only fire-resistant hydraulic fluid approved by the C.A.A. Now in use by 31 major airlines,* Skydrol has logged over 4,000,000 flying hours. It costs less than you think to convert your planes to Skydrol. For more information or FREE Skydrol technical bulletin, write Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478-J-6, St. Louis 1, Missouri.

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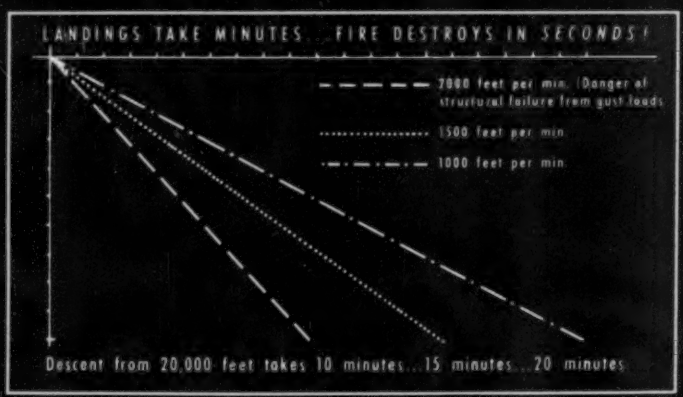
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7000 feet per min. (Danger of structural failure from gust loads
1500 feet per min.
1000 feet per min.
Descent from 20,000 feet takes 10 minutes . . . 15 minutes . . . 20 minutes

The length of time required to land from high altitude emphasizes the danger of fires in flight. Skydrol hydraulic fluid helps prevent these fires because it is a fire-resistant chemical, not an oil. Skydrol also outlasts mineral oil, actually saves money.

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ALSO ON THE MARKET

Mylar kit No. 1 helps solve the problem of underwing corrosion from exhaust gases. The kit includes materials for cleaning surface contamination from corroded areas. Then a .005-in.-thick permanent Mylar shield is applied. The shield is easily wiped clear when necessary. Douglas Aircraft cooperated in development of the technique.—Coast Pro-Seal & Mfg. Co., 2235 Beverly Blvd., Los Angeles 57, Calif.

Deoxidizing Compound 80 is a non-chromic-acid-containing material for stripping all types of anodic coatings from aluminum parts and racks. It is used in water solution at room temperature for removing anodic coatings by immersion only. Average coatings are removed in a few seconds.—Enthone Inc., New Haven, Conn.

Cincinnati all-steel press brake Series 2-30 has a capacity of 30 tons and will bend 6 ft. of 14 gage mild steel. Machine has a distance between housings of 5 ft. 2 in. and an overall die surface of 6 ft. . . . The **3-50 series press brake** has a capacity of 50 tons and will bend 6 ft. of 10 gage mild steel.—Cincinnati Shaper Co., Hopple, Garrard & Elam Sts., Cincinnati 25, Ohio.

Flush-Lok set screw, designed for uses in which the slab portion cannot extend beyond the tapped hole, gives a positive locking action that can be retained in all positions. Made with an undersize slab to permit flush insertion, it is possible to set the screw to the same holding power as a socket screw. —Set Screw & Mfg. Co., Main St., Bartlett, Ill.

Vertical precision boring machine, Style 432, turns bores, faces, grooves and chamfers, in combination or separately. Each of two stations has a separate hydraulic system, counterweighted compound tool slide, vertical spindle, drive equipment controls. During machining operations at one station the other station can be unloaded, loaded and started on its automatic cycle. Individual controls prevent the operation of one station effecting the other.—Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Lightweight two-way headset weighs 3.4 oz. Sound is piped into ears through twin tone arms, leaving ears uncovered for comfort.—Dept. KP, Telex, Inc., Telex Park, St. Paul 1, Minn.

Walk-in type environmental test and storage chamber is prefabricated. Aluminum and plastic parts and raw stock may be stored at predetermined low

Military Combat Team Maneuvers

20 TOUGH GUYS IN A HURRY

General Forrest would have loved the Piasecki H-21 helicopter. It "gits thar fustest with the mostest men." Twenty heavily armed men can be transported from advanced air fields direct to combat areas.

Not only troops, but other material can be hauled by the H-21 workhorse. It's capable of carrying loads over two tons and has been especially designed to perform a wide variety of rugged military and commercial tasks.

The tandem rotor arrangement, with its inherently powerful control system, permits operation under many and varied conditions. Whether used in the tropics or the mountain areas in the North, the H-21 is recognized for its speed, range, lifting power and ease of maintenance.

For rapid cargo transport, large trucks can be unloaded directly into the cabin through two doors without stopping rotors.

This new carrier is just another result of Piasecki Helicopter Corporation's unceasing effort to improve helicopter performance — to build helicopters to do more jobs and do them better than ever before.

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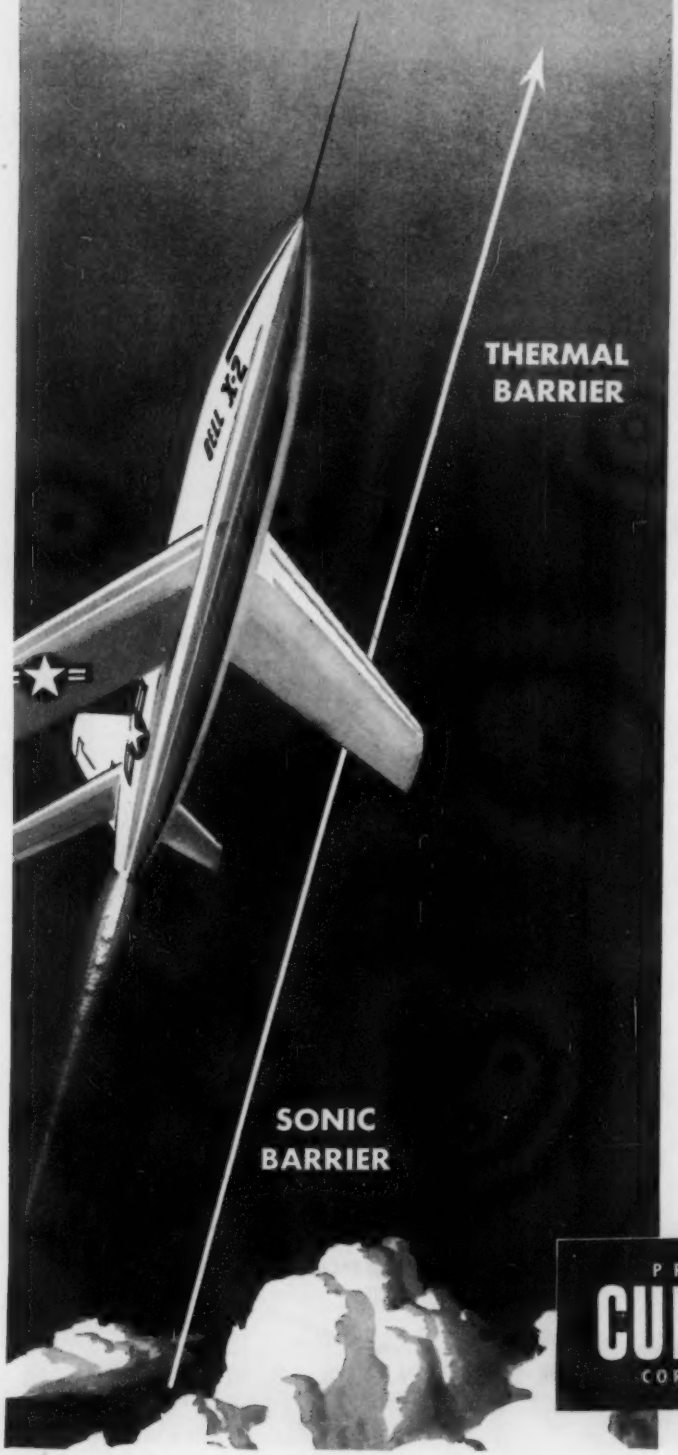
ROCKET POWER and the BELL X-2



The rocket engine that powers the new Bell X-2 is one more example of the advanced design concepts that have earned for Curtiss-Wright its leadership in the aircraft industry.

Exploring the problems of the "heat barrier" . . . where windshields melt and ordinary aircraft metals disintegrate . . . the X-2 employs a thrust equal to the power that drives a Navy cruiser at high speeds. Searing through the sonic barrier (yesterday's problem) and far beyond, it will gather data vital to America's future in the air. Its pilot will be able to throttle the engine up and down, for faster or slower speeds, and start or stop it . . . at will. He will select from a wide range of throttle positions . . . proportioning his fuel and controlling rocket thrust . . . another Curtiss-Wright *first* that makes rocket power practical for tactical aircraft.

Other advanced propulsion systems developed by Curtiss-Wright are powering leading airlines to new records as they go in service on latest re-equipment programs . . . are providing our air forces, and those of our allied nations, with long-awaited *bonus power* for today's spectacular developmental as well as operational aircraft. And there is more . . . much more . . . to come from Curtiss-Wright.

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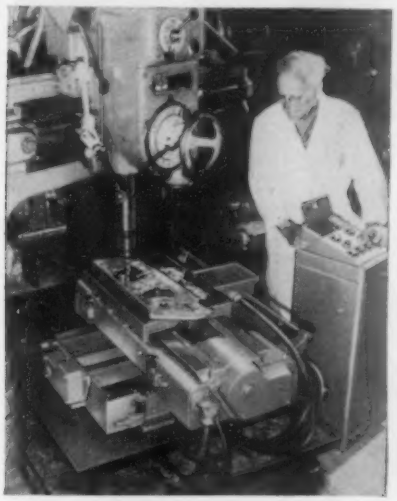
temperatures with absolute control of humidity. It also can be used in testing various materials and equipment at temperatures as low as −120 deg. F. and as high as +250 deg. F. Humidity may be controlled in standard units from 20 to 95% between 35 and 185 deg. F.—Webber Manufacturing Co., Dept. W-1, 2740 Madison Ave., Indianapolis, Ind.

Micro-Positioner is automatic device for locating production parts under all types of vertical spindle machine tools. Table is controlled by means of a steel tape indented by an automatic marking



device from information on blueprints or by locating the vertical spindle machine tool over a previously marked part.—Micro-Positioner Corp., 1151 S. Broadway, Los Angeles, Calif.

Air-operated shear is used for cutting cold ferrous and nonferrous bars up to 1¾ in. square or round. The unit operates from any standard shop air supply or compressor at pressures from 60 to 125 psi. Type O-SC-20 air shear has 10 in. knives with four cutting edges which can be adjusted by set screws after grinding. This shear will cut 1¾ in. diameter cold mill steel at 80 psi air pressure.—Curry Air Shear Corp., 941 Oliver Bldg., Pittsburgh 22, Pa.

Multi-groove edge planers for hard plastics are one-piece tools turned out on a lathe with any angle or radius grooves cut into the side or face and used in high speed drill press or routing head. Edge of the work is pushed across the perimeter of the planer which smooths the edge or cuts the desired angle or radius.—Dia-Chrome Co., 722 S. Verdugo Rd., Glendale 5, Calif.

New paper-sizing agent, "Scotchgard" grease and oil repellent size, is said to coat every fiber with an oil-resistant film without affecting the strength, porosity,

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more facts about the Eland
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* Low specific fuel consumption — 0.450 lbs./e.h.p./hr. at 36,000 ft. 400 knots cruising: 0.505 lbs./e.h.p./hr. at 20,000 ft. 350 knots cruising.
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* Automatic temperature compensation.
* At the first attempt the Eland has recently passed a 150 hour type test rehearsal at the full 3,000 e.h.p. rating.
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flexibility, appearance or color of the material. Agent is used in a water solution and is sprayed on the moving web of paper or applied as it passes through the size press.—Minnesota Mining & Manufacturing Co., 900 Fauquier St., St. Paul 6, Minn.

Puller set removes all sizes of oil seals from ⅞ to 4⅛ in. The set consists of two hammers and twenty expanding heads.—Patton Manufacturing Co., 1802 W. Pleasant St., Springfield, Ohio.

Panel Casing Aero Heat Exchanger provides water saving in industrial cooling and controls temperatures within 2 deg. F. The machine cools by evaporation and obtains temperature control by modulating the use of outdoor air. If heat is required instead of cooling it is provided either with heat or electricity by a heater in the spray water tank. —Niagara Blower Co., 405 Lexington Ave., New York 17, N. Y.

Flexible hose for jet engines has Teflon inner core said to withstand high temperature and chemical attack. Outside braid of stainless steel provides support against high internal pressures. Hose can be used in a temperature range of −100 F. to +450 F.—Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5. N. J.

Prod-Seal #727, potting compound, withstands thermal shock and forms resilient, low shrinkage rubber. Resistant to gasolines, oils, greases, pressure lubricants, water and weathering, it is reported to be capable of withstanding temperatures from −60 F. to +189 F.—Coast Pro-Seal & Mfg. Co., Los Angeles, Calif.

KF-3 Aquameter can determine moisture content of jet fuels, lubricating oils and other petroleum products. High-speed instrument performs Karl Fischer titrations automatically and is not limited to materials miscible in methanol.—Beckman Division, Beckman Instruments Inc., Fullerton, Calif.

New 7½-ton deep throat press for precision stamping has one-piece, alloy steel, heat-treated and precision-ground crankshaft. Driving mechanism is self-contained in the clutch collar eliminating slots in crankshaft. Press can be furnished in single or double-hand control or foot control.—Kenco Manufacturing Co., 4211 Telegraph Rd., Los Angeles 22, Calif.

Low-level sampling switch has semi-molded construction with 6 pole, 540 contact. Each pole can be individually adjusted in phase relative to the other poles.—General Devices Inc., Princeton, N. J.

MISSILE

SYSTEMS

aerodynamics

The rapid growth of missile systems technology has placed new demands on the ability of aerodynamics scientists. At Lockheed Missile Systems Division, new advances are required constantly in thermodynamic analysis, aerodynamic design analysis, flutter, aero-elastics and flight dynamics.

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EXPERIMENTAL AERODYNAMICS ENGINEER — to plan, supervise, analyze and report on experimental programs. The position requires a sound background in supersonic aerodynamics and at least five years' experience, preferably in wind tunnel testing or full-scale and free flight model testing.

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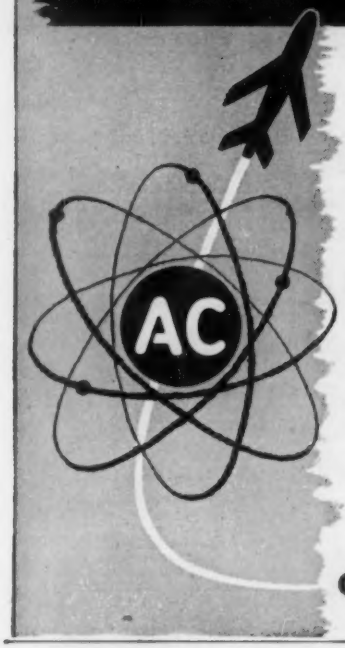

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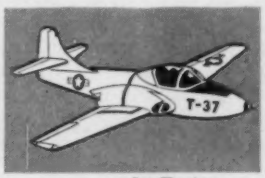

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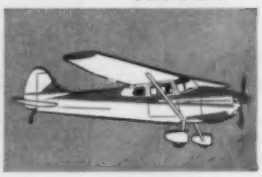
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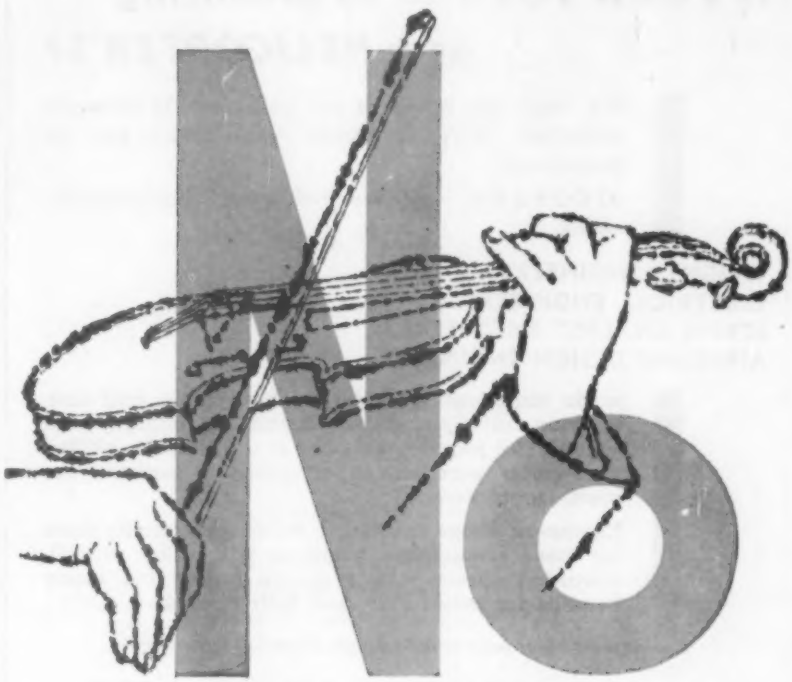

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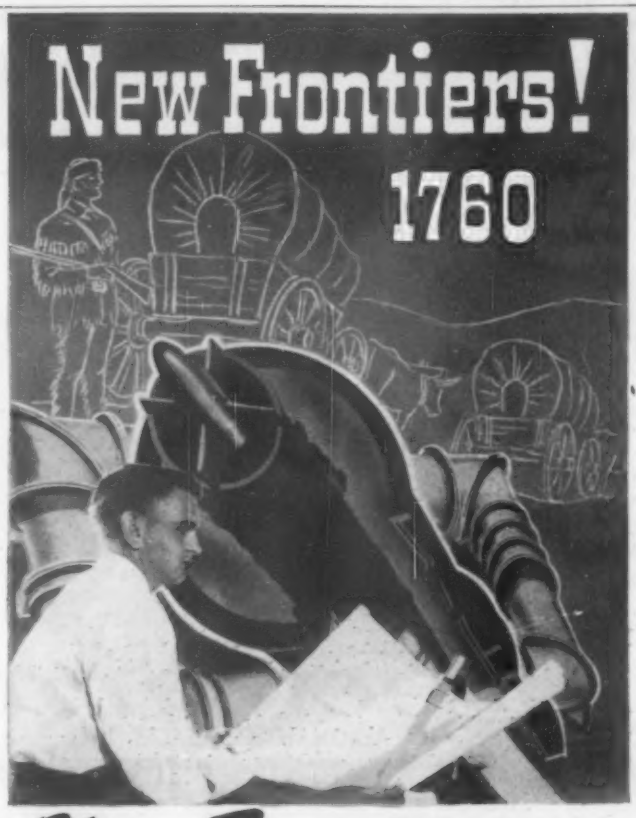

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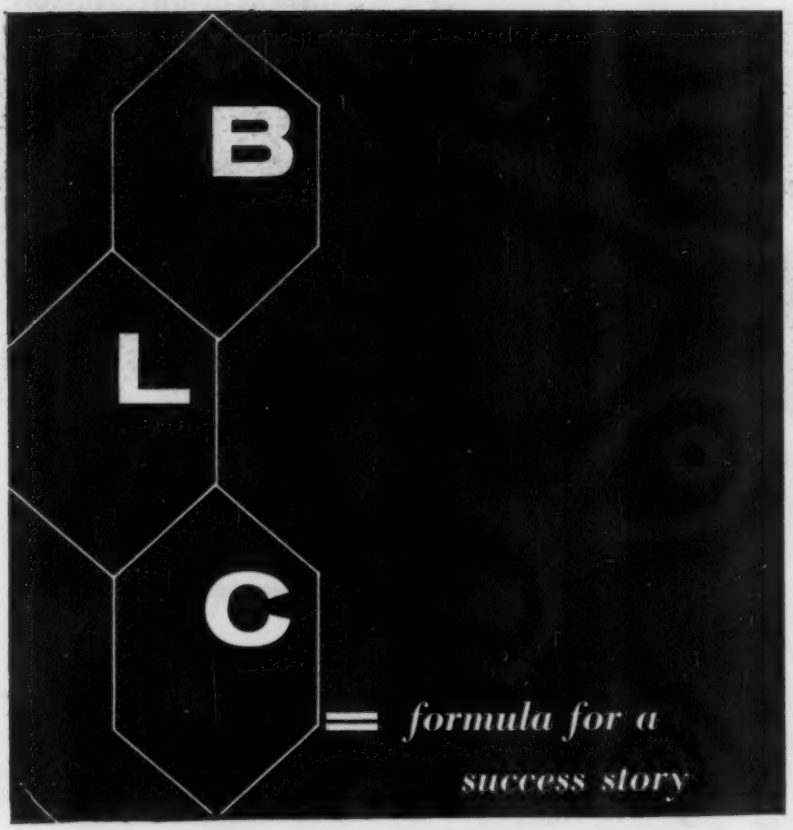

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WHO'S WHERE

(Continued from page 9)

John W. Downs, senior staff engineer, Radiation, Inc.

James Byers, assistant service manager, Aerodex, Inc.; **William Hunt**, assistant production superintendent.

R. Neil Ritter, Atlanta district sales manager, Capital Airlines.

John J. O'Neil, executive assistant to the director, Cornell Aeronautical Laboratory, Inc.

Nathaniel B. Nichols, manager of commerical equipment engineering at Raytheon Manufacturing Co.

William R. Alexander, engineering director of The Steel Products Engineering Co.

Maurice McGregor resigned as general manager of Pakistan International Airlines.

Richard Johnson, Syracuse sales manager of International Resistance Co.; **Thomas E. Davis**, salesman.

Martin G. Gale, technical service director of Monomer Dept. of The Borden Company's Chemical Division.

Charles Hagedorn, sales representative, Northwest Orient Airlines.

George Mauraides, Toledo representative of Lewis-Shepard Products, Inc.; **Nelson L. Hammell**, New York City representative.

Zbyslaw M. Ciolkosz, chief of design and analysis, Piasecki Aircraft Corp.; **Frank E. Mamrol**, chief design engineer; **Herbert G. Somerson**, chief analytical engineer.

William Patterson, Jr., jet engine specialist for engine-mounted oil-hydraulic controls and equipment, Vickers Inc.

Capt. John H. Ganley, divisional chief pilot, Mohawk Airlines.

Henry Aaron, highway and airport engineer, Wire Reinforcement Institute. Aaron was formerly C.A.A. chief of airports technical branch.

R. S. Buritz, **John L. Rutkowski** and **Panagiotis D. Georgantas**, project engineers, instrument division of Thomas A. Edison, Inc.; **Charles A. Lord**, industrial engineer.

William G. Smith, chief engineer, Pachmayr Corp. Also appointed: **Richard Stemmler**, consulting metallurgist.

Charles Hazzard, sales engineer, Templet Industries, Inc.

Fred W. Fisher, editor of CEC Recordings, a publication of Consolidated Engineering Corp.

William Randall Johnson, Jr., station traffic manager at Port Au Prince, Haiti, Pan American World Airways.

Floyd F. Homstad, Georgia division military relations representative at Oklahoma City, Lockheed Aircraft Corp.

Dale A. Danielsen, superintendent of communications department, Riddle Airlines.

W. I. Maclean, Washington representative, Lucas-Rotax Ltd., Toronto and Montreal, Canada.

George S. Kaibel, Dayton representative, Fletcher Aviation Corp.

Murray R. Petersen, Ohio sales engineer, The George Sall Metals Co., Inc.

Derek O. Thurgood, publicity department, The Fairey Aviation Co. Ltd., London, England.

Ralph Bonafede, production manager, Republic Aviation Corp.

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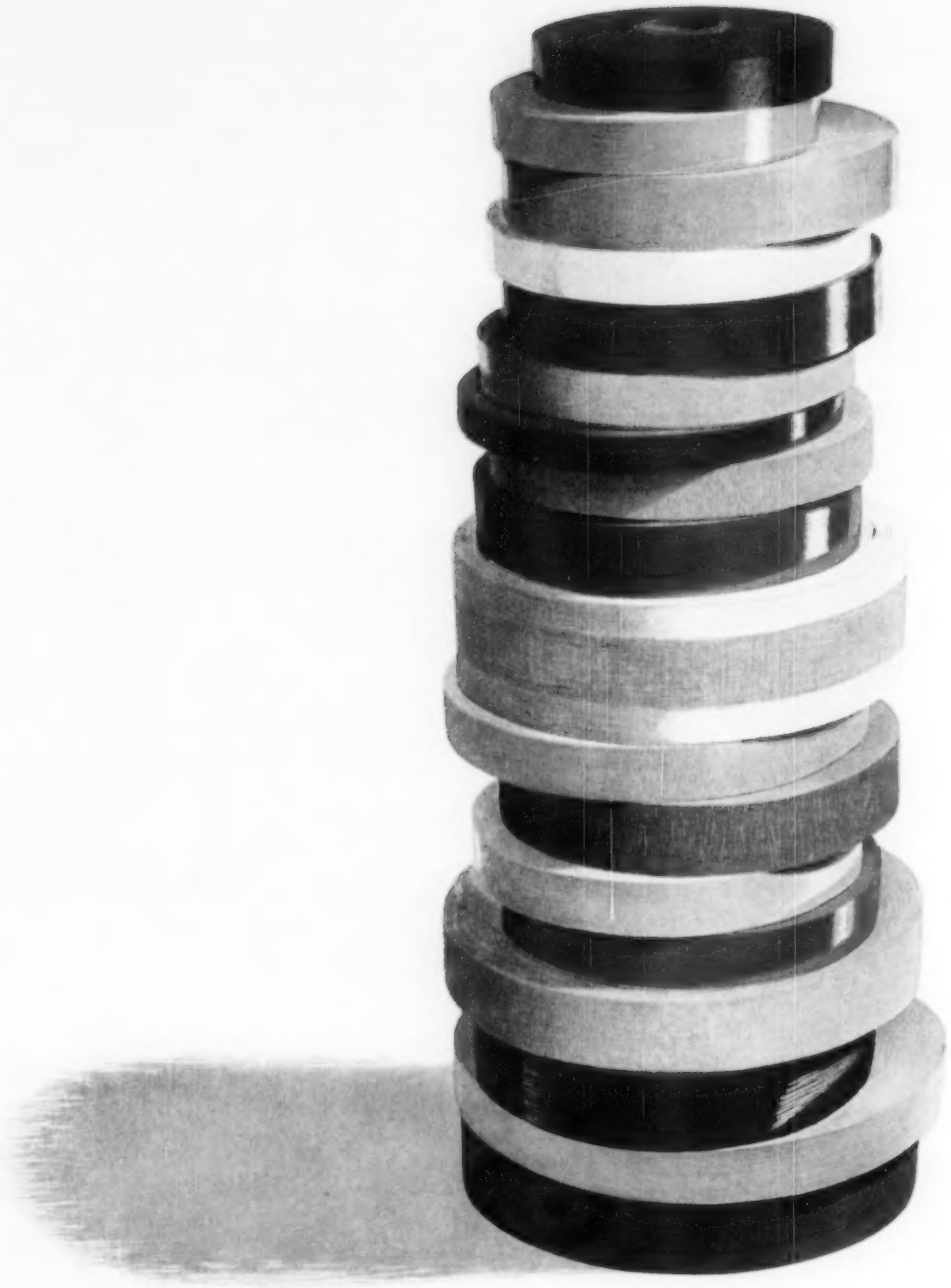

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CAB Goal: Abolish Mail Case Backlog

Carriers face reduced pay as Board moves to apply 'Offset' principle in computing final compensation.

By Katherine Johnsen

Washington—The Civil Aeronautics Board is aiming to set a record this year by disposing of more than 70 mail rate cases, some dating back a decade.

Enthusiastically abetting the Board's aim to get on a current basis, Congress voted $100,000 for additional mail rate personnel. So far, though, the Board has only added one employe for the fiscal year, starting last July 1.

Of the estimated 110 cases which will come up for Board action, more than 60 were carried over from previous years. If the Board meets its goal of disposing of more than 70 cases, there still will be a carry-over of almost 40 cases into Fiscal 1957.

In its mail rate actions, the Board is under two other strong pressures: Post Office Department wants service mail rates cut—as low as possible; Congress wants subsidies cut—as low as possible.

Offset Battle

The heaviest political pressure on the Board is to recapture funds by application of the "offset" principle, declared by the Supreme Court a year and a half ago, under which the excess earnings on one segment of a carrier's operation are applied against subsidy requirements of other segments.

Congress has repeatedly balked at granting Board requests for appropriations for subsidy payments because of CAB's slowness in following through on the court decision. The Post Office Department has made the controversial claim that up to $50 million might be recaptured under application of "offset."

The Board is now acting on cases applying the principle to four carriers: Pan American World Airways, Trans World Airlines, Braniff Airways and Delta-C&S Airlines.

In the PAA-TWA case, CAB counsel has proposed a recapture of $23 million from the two carriers to be applied against subsidy payments for the North Atlantic operations for the 1946-53 period. The counsel found that PAA's excess earnings (over 10% of investment) on its Pacific, Alaska, and Latin American Divisions amounted to more than $13.9 million. TWA's excess earnings (over 8% of investment) on its domestic operations were set at $8.9 million.

The case opened with some fireworks: CAB on a 3-2 vote turned down a request by TWA that tax savings on new equipment—under the rapid write-off program to encourage the build-up of commercial airlift—be considered as an expense item. The decision meant that $3 million in tax accruals will be considered for offset against subsidy. TWA petitioned that CAB Chairman Ross Rizley—who voted with members Joseph Adams and Josh Lee in denying the TWA request—should be disqualified on the ground that as Solicitor of the Post Office Department in 1953 he was a proponent of "offset."

The examiner's hearing in the Delta-C&S Offset Case, dealing with the 1946-51 period, will be held in a week. The CAB staff is processing the Braniff Case.

The Board estimates that for the recent period since subsidy and mail pay were separated (September 1953-July 1, 1955), there is more than $6.3 million available for recapture by application of "offset": $5.1 million from PAA; $1.1 million from Delta-C&S, and $91,000 from Braniff.

Feeder Mail Outlook

• **Local service.** The Board is moving to put the 13 local service lines on a uniform multi-element mail rate, after the pattern of the trunk carriers. The estimated saving in service mail pay is $250,000 a year. But subsidy would probably have to be increased by the same amount.

The local lines are resigned to a multi-element rate, probably $1 a ton-mile, plus fees for enplanings. But they are not enthusiastic. They dislike the idea of increased subsidy. On the other hand, there is apprehension that if service rates are not reduced, the Post Office will be reluctant to give them mail business.

• **Surface mail by air.** Airlines shipping regular first-class mail by air on a space-available basis face a fight on several fronts to keep the business. Railroads are vigorously protesting the program at the Board, in the courts and in Congress, claiming that it is illegal to ship mail that does not have airmail postage by air.

The next major development ex-

Undecided Mail Rates

Every scheduled airline—with the exception of Eastern Airlines—now has a mail rate case up for decision by the Civil Aeronautics Board. Here is a breakdown on cases open (O), showing also those that have been closed (C) with final mail rates. American Airlines, Trans World Airlines and United Air Lines have both closed and open cases in the surface mail experiment. Final rates have been set for the West Coast experiment but only temporary rates for the East Coast experiment.

INTERNATIONAL CARRIERS

Carriers	SERVICE MAIL PAY: Total Compensation	Regular Air Mail	Surface Mail Experiment	Back Mail Pay
American	C	C		
Braniff	O	O		O
Caribbean-Atlantic	O	C		
Colonial	O	C		
Delta	O	O		O
Eastern	C	C		
National	C	C		O
Northwest	O	O		O
Pan American:				
Atlantic	C	O		O
Latin American	O	O		O
Pacific	O	O		
Panagra	O	O		
Trans World	C	O		O
United	C	C		O

DOMESTIC TRUNKLINES

American	C	C	CO	
Eastern	C	C	C	
Trans World	C	C	CO	
United	C	C	CO	
National	C	C	C	O
Northwest	C	C	O	O
Braniff	O	C		
Capital	C	C	C	
Delta	C	C	C	O
Western	C	C	O	O
Colonial	O	C		
Continental	C	C	C	
Northeast	C	C		

LOCAL SERVICE CARRIERS

Allegheny	O	O	C
Bonanza	O	O	C
Central	O	O	C
Frontier	O	O	C
Lake Central	O	O	C
Mohawk	O	O	C
North Central	C	O	C
Ozark	O	O	C
Piedmont	O	O	C
Southern	C	O	C
Southwest	C	O	C
Trans-Texas	C	O	C
West Coast	O	O	C
Helicopter	C	C	
Los Angeles	C	C	
New York	C	C	

TERRITORIAL CARRIERS

Alaska	O	C	O
Alaska Central	C	C	
Byers	C	C	
Cordova	O	C	
Ellis	C	C	
No. Consolidated	C	C	
Pacific Northern	O	C	
Pan American	C	C	
Reeve	C	C	
Wien	O	C	
Hawaiian	C	C	
Trans-Pacific	C	C	

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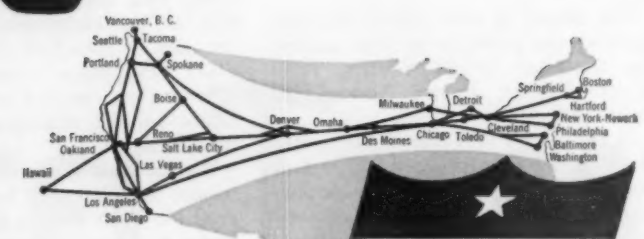

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UNITED AIR LINES

pected is the decision of the U.S. Court of Appeals. The U.S. District Court approved the shipment of surface mail by air on an experimental basis, but declared that a permanent program would require authorizing legislation. This raised question as to when "experimental" becomes "permanent."

The Postmaster General strongly favors the program and wants to continue it, claiming it is saving the department substantial money on mail shipment.

Meanwhile, Eastern Air Lines, TWA, and other scheduled carriers have filed suit with the U.S. District Court protesting the authority CAB granted to all-freight certificated carriers—Flying Tiger Line, Slick Airways—to transport surface mail to the Post Office.

CAB is reconsidering rates for surface mail, now approximately 20 cents a ton-mile, or less than half the rate paid most carriers for regular air mail shipments. An examiner's hearing is scheduled in mid-October.

In Congress, the staff of the House Post Office Committee is studying the surface mail-by-air program, anticipating action on the issue when Congress returns in January.

• **International service rates.** The Board has taken two important steps toward establishing permanent service mail rates over international routes but is stumbling on the final, and essential, step.

In show cause orders, CAB has set a rate of 53.5 cents a ton-mile for the North Atlantic and rates for the Latin America area varying from 34 to 65 cents a ton-mile over different route segments.

But no solution is in sight to the controversy over mail pay rates for the Pacific area routes of PAA and Northwest Airlines.

PanAm Pilots Test Turbojet Boeing 707

Three Pan American World Airways engineering pilots conducted the first complete airline flight evaluation tests last week of the Boeing 707 turbojet transport.

Franklin Gledhill, PAA vice president, said the company has not reached a decision on purchasing jet transports but noted that the data obtained in the test flights will be used in making a final decision.

PAA's pilots flew the Boeing prototype jet airliner to evaluate specifically the plane's performance against airline needs.

Pilots were: Captains Scott Flower, Atlantic Division; James Fleming, Pacific-Alaska Division; and Richard Vinal, Latin American Division.

Copter Traffic Control Requires Highway Techniques, IATA Says

When it comes to traffic control, the helicopter is more like a surface vehicle than an airplane and route structures must be more like highways than air lines, the International Air Transport Assn. believes.

IATA's Helicopter Group, reporting on a meeting held in Brussels last February, has set up these requirements for "helicopter highways" serving downtown population centers:

• **Main routes** must not penetrate cities but bypass them with feeder routes running into the heliports.

• **All routes** must be clearly defined and easy to follow.

• **There must be underpasses** and overpasses, no level crossings of routes.

• **All routes** must be one-way roads.

• **There must be parallel** speed lanes for use of traffic with different cruising speed.

• **In establishing helicopter lines,** consideration must be given to terrain, obstacles, control zones, military and restricted areas, noise and the relative location of downtown centers to be served.

• **Mixed traffic** must be avoided; route structures of helicopters and fixed-wing planes must be kept separate even at airports.

Urging immediate action to solve the helicopter air traffic control problem, the group predicted that introduction of the passenger helicopter is going to be so rapid that development of the system probably will lag behind the needs of the aircraft.

"It probably will be some time," the report says, "before a let-down can be carried out under conditions of very low visibility or cloud base in city centers where there are many obstacles. In the meantime, it may be wise to let down outside the city and to proceed into the congested area flying contact.

"This could be done even under very low visibility conditions, since it would be possible to proceed at low forward speeds. The ceiling would still have to be reasonably high, unless favorable access-ways existed into the city center such as canals and big roads, rivers or green belts, which the helicopter could follow."

So far as navigational aids are concerned, the IATA group says it is mandatory that they operate with a high degree of accuracy at altitudes below 2,000 ft. over highly congested areas.

Design limits of an acceptable helicopter navigational system were also defined:

• **Equipment** must be as light as possible.

• **In terminal areas** coverage must be available from ground level. Enroute coverage is desirable from ground level but is required from at least 500 ft. above the terrain.

• **The system must give** continuous visual information of the aircraft's position on the track or route. Where there are multiple routes, accuracy must permit the pilot to keep within 1,000 ft. of his intended path. This figure must be cut to 500 ft. in certain terminal areas.

• **The system must provide** acceptable all-weather reliability.

• **Control must be possible** for the

IATA Proposes Heliport Standards

Proceeding with its basic philosophy that heliports must come before helicopters, the International Air Transport Assn. has fixed its sight on a 200 by 400-ft. platform atop a two-to-four-story downtown building.

Turning to the manufacturers of rotary-wing aircraft, IATA's Helicopter Group has told them that future multi-engine helicopters must be designed to operate out of such a facility with complete safety even in case of an engine failure.

The commercial operators did not, however, fully accept the challenge of U. S. helicopter manufacturers to define in detail what they want in a commercial aircraft. The IATA report fails to mention size, passenger comforts, baggage handling and other items usually specified for fixed-wing manufacturers.

The report does list information demanded from manufacturers when they are offering a new passenger helicopter for sale with a warning that it is "substantially different from that customarily supplied by manufacturers of fixed-wing aircraft."

The 200-by-400-ft. heliport is expected to resemble a modern bus terminal. It will be near city centers or other major traffic generating areas but away from high buildings. It will have easy access for autos and be within 300 yards of surface travel connections.

There will be a control tower, IATA expects, and room for temporary parking. Maintenance and storage facilities will be somewhere else, probably at the city airport.

Turnaround time must be kept to 12 min. for local flights.

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pilot with a minimum of complexity.

The report also calls for improved approach and departure aids, collision warning devices, communications equipment and a more accurate altimeter—all necessary to efficient commercial helicopter operations.

The Brussels meeting was attended by operators from 11 nations, including the United States.

IATA Meetings

The International Air Transport Assn. will hold two meetings this month at Miami Beach, Fla., with one session devoted to international air tariffs for the 1956-57 traffic year and the other to study future requirements for air navigation facilities and services in the Caribbean area.

International air fares and rates are to be considered by the IATA traffic conferences in sessions at the Fontainbleau Hotel beginning Sept. 20 for approximately three weeks.

The Caribbean Technical Panel will meet in the Golden Gate Hotel from Sept. 27 through Oct. 5. Operations and engineering experts of IATA member airlines serving the Caribbean area will confer in this session on recommendations for presentation at the regional Air Navigation Meeting of the International Civil Aviation Organization at Ciudad Trujillo in April.

Hugh B. Main, general traffic manager of Canadian Pacific Air Lines, is chairman of the traffic conference and Capt. A. D. Snitzlaar, general operations manager of KLM Royal Dutch Airlines, West Indies Division, will be chairman presiding over the technical panel.

Godfrey Faces Inquiry

Civil Aeronautics Administration began an investigation last week of charges filed by Ozark Airlines that a DC-3 aircraft owned by Arthur Godfrey, television and radio performer, crowded one of its planes.

The inquiry is being conducted by CAA's regional Chicago office where the formal complaint was lodged. It was alleged that Godfrey's plane took off Sept. 7 from Chicago's Midway Airport approximately 55 seconds behind an Ozark DC-3, flew 100 ft. off the airliner's right wing and then crossed directly in front of the Ozark plane.

Godfrey's aircraft has been modified to produce extra power.

CAA in Washington said no formal action would be taken pending a complete report of the incident. A year ago Civil Aeronautics Board suspended Godfrey's pilot license for six months after he buzzed an airport tower at Teterboro, N. J.

New Transcontinental Airfreight Service Offered by American

A new concept in airfreight service providing reductions averaging 50% in transcontinental rates will be initiated by American Airlines with the introduction of a new class of service called "deferred airfreight." (For other American moves in the airfreight fields, see 142.)

The distinctive feature of this new class of airfreight service is establishment of a deadline time before which shipments will not be released to the consignee. This is to prevent "deferred airfreight" from becoming competitive with other classes of air cargo service, according to American.

Rates and general conditions of the new service have been filed to become effective on Oct. 12, subject to Civil Aeronautics Board approval.

The service will be offered to shippers east and westbound between Los Angeles or San Francisco and New York or Washington, D. C., and Los Angeles and Chicago.

C. R. Speers, American's senior vice president-sales, said that "deferred airfreight" is planned as a faster service than normal surface competition at comparable rates. He said it has been made possible by the additional cargo capacity on American's Douglas DC-7 transcontinental passenger schedules. Tariff conditions also are designed to attract a special kind of shipment which can be accommodated on these aircraft, he added.

The primary conditions governing the "deferred airfreight" service are:

- **Shipment by a single shipper** shall be distributed over at least five consecutive days at a minimum of 500 lb. per day.
- **A minimum of 15%** of the five-day total must be shipped each day.
- **No more than 25%** of the five day total may be shipped on any one day.
- **Shipments originating** on the East Coast will not be released to consignee on the West Coast until 5 P.M. on the second day following the shipment.
- **Shipments originating** on the West Coast will not be released to the consignee on the East Coast until 5 P.M. of the third day.
- **Maximum weight** of any single package will be 100 lb. and maximum dimensions of any single package will be 24 in. by 36 in. by 45 in.

Speers emphasized that "deferred airfreight" is designed chiefly to create new business by attracting traffic now moving by ground transportation. He said it should result in minimum diversion from existing air cargo traffic. However, industry observers note that American's proposed service should be particularly attractive to airfreight forwarders operating coast to coast. Restrictions on the service applicable to each shipper follow in minute detail the requirements of air freight forwarders.

It was acknowledged by Speers that "the service should be popular with volume shippers of small packages who . . . through consolidation, will take advantage of the new low rates."

Among the rates proposed, as quoted in American's tariff filed with CAB, are charges eastbound from Los Angeles to New York of $12 per 100 lb. and westbound from New York to Los Angeles of $15 per 100 lb.

Delta Shortens Title

Delta-C&S Air Lines announced last week that it plans to "gradually" drop the Chicago and Southern portion of its operating name and return to the corporate name of Delta Air Lines. The airline has operated as Delta-C&S since its merger with Chicago and Southern on May 1, 1953. Aircraft markings, signs and stationery, etc., will be changed gradually in order to ease the corporate name back into the public mind and avoid any abrupt change.

Rizley Pledges Speed On Airworthiness

A speed up in the adoption of amendments to airworthiness regulations by the Civil Aeronautics Board was promised last week by Chairman Ross Rizley.

Rizley told representatives of industry, Civil Aeronautics Administration and the CAB meeting in Washington for the annual airworthiness review that the amendments will be adopted by the first of the year or very shortly thereafter. He pointed out that the 1954 amendments were not put in force until last July.

The CAB chairman noted that many of the agenda items before the 1955 meeting dealt with subjects affecting the design of turbine-powered aircraft. "As usual, in the matter of regulating safety into design," he said, "there exists the problem of whether regulations should precede or follow experience with radically new designs."

Rizley said CAB has subscribed to the philosophy that regulations should reflect knowledge gained by experience.

"Until such time as experience in designing the new type airplanes warrants

the inclusion into the regulations of detail provisions more specifically and realistically applicable to turbine-powered airplanes," Rizley said, "It will be necessary to provide for greater administrative latitude in the certification of new airplane types."

Rizley said that Civil Air Regulations governing performance require amending. "Much work has been done," he said, "in laying the foundation for revised concepts on airplane performance. We are probably reaching the point when in the not too distant future a set of performance requirements can be developed."

Regarding rotorcraft airworthiness, Rizley said that final work on revising these sections of the regulations was in progress and would be ready for CAB consideration in about a month.

Accident Rate Report By Scheduled Lines

A fatality rate of .36 per 100 million passenger-miles for the 12 month-period ending Aug. 31 was reported by Air Transport Assn. for the scheduled domestic and international airlines.

During this period the scheduled airlines had seven accidents—six domestic; one international—resulting in fatalities to passengers and 17 flight crew members.

The airlines carried some 40-million passengers over 23 billion passenger-miles during the period.

Breakdown by carrier group shows:

- **Domestic trunklines**—A total of 33 million passengers were flown 18.3 billion passenger-miles with 96 fatalities for a fatality rate of .43 per 100 million passenger-miles.
- **International**—A total of 3 million passengers flew 4.2 billion passenger-miles with four fatalities for a fatality rate of .05.
- **Local Service**—A total of 2.7 million passengers flew 519 million passenger-miles with no fatalities. This makes 53 months without a fatal accident for the local service carriers.
- **Territorial**—A total of 714,000 passengers were carried 87 million passenger-miles with no fatalities. This is a record of 306 months without a fatal accident.

Canadian Licensing

Toronto—Gopher Aviation Inc., of Rochester, Minn., has had its international nonscheduled charter license renewed for three years by the Canadian Air Transport Board.

The license permits the company to fly to points south of the 54th parallel in the provinces of Alberta, Saskatchewan, Manitoba, Ontario and Quebec with aircraft having a disposable load of less than 6,000 pounds.

Coach Traffic Competition Keen

All three major transcontinental air carriers—American Airlines, Trans World Airlines and United Air Lines—are competitively equal this week for the first time on new low-cost excursion fares of $160.

TWA enjoyed a short-lived advantage over the competition by getting its fare reductions filed with the Civil Aeronautics Board for an effective date of Sept. 12. United's identical fare proposal took effect four days later on Sept. 16, and American's on Sept. 17.

As a result of CAB's approval of the reductions, air coach travellers are now enjoying savings of $33 to $38 per trip on coast-to-coast flights from previous round-trip fares. CAB said its action was in line with the policy of making the benefits of air transportation available to more people at reduced fare levels.

The newly adopted $160 round-trip fare is applicable for travel from Monday through Thursday between the East Coast cities of Baltimore, New York, Newark, Philadelphia and Washington and West Coast points of Los Angeles, Oakland, San Francisco, Fresno and San Diego.

Industry opinion is divided as to the trend the rate reduction may develop. Opponents claim reducing coach fares is the wrong way to increase passenger traffic.

Proponents now believe that coach

British Watch Comet 3 Perform; Pin Jet Hopes on Its Successor

fares will be lowered for intermediate points and the short-haul market. First indication should be apparent within six months when there must be a decision whether to extend the "experimental" $80 transcontinental fare beyond March.

Another effort by the industry to attract more passenger traffic, which is equally unsettled, is revision of the family fare plan. When first initiated to draw passengers on light traffic days, the family plan applied Monday through Wednesday. American Airlines, joined by Mohawk Airlines, has proposed a departure from tradition with a family fare plan which reduces rates for a man traveling with his wife and/or children from noon Monday to noon Thursday. Subject to CAB approval, the American and Mohawk change will take place Oct. 9. Meanwhile, a majority of the domestic carriers are converting family plan days to Tuesday through Thursday with less than eight sticking to the old Monday-Wednesday program.

Principal objection to the new American plan is the belief it will be hard to administer.

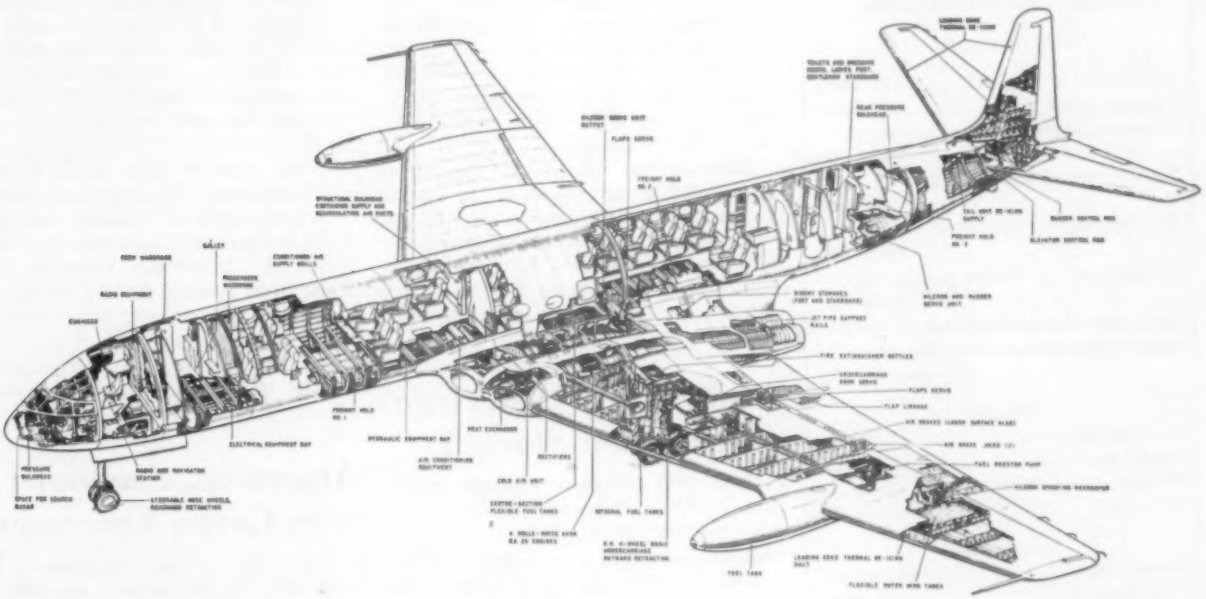
The carriers have long been aware that over the years a decided shift in the daily traffic flow has occured which requires re-adjustment of promotional fares to retain their benefits. However, at the moment, the lack of unanimity being displayed is blamed on the highly competitive nature of the industry and observers predict a uniform switchover eventually will be made.

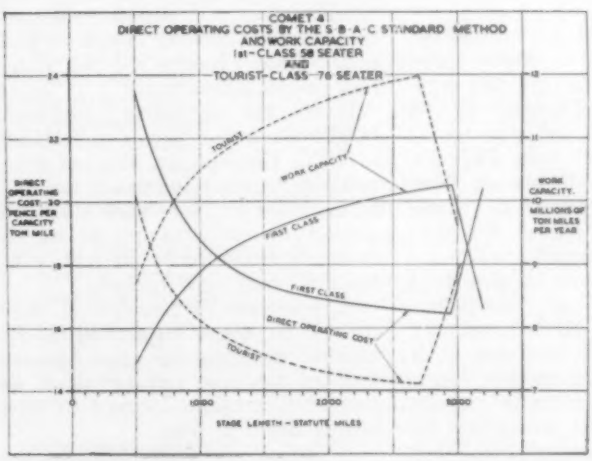
Indo-Japan Air Treaty To Be Signed Soon

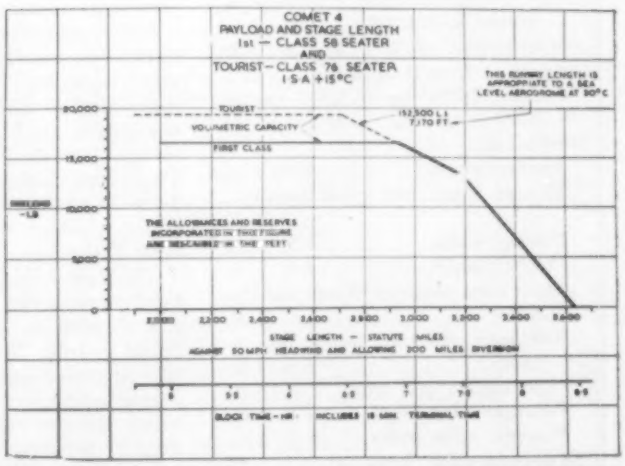
New Delhi—Raj Bahadue, Indian Deputy Communications Minister, has informed the parliament's Council of States that terms of a bilateral air agreement between India and Japan has been finalized.

He stated that a formal signing will take place as soon as the necessary formalities can be arranged. A similar agreement with Thailand, he said, will also be signed sometime within the near future.

The details of the Thailand agreement were originally worked out by Thai and Japanese officials in a series of meetings in April, 1952.




COMET 4
DIRECT OPERATING COSTS BY THE S.B.A.C. STANDARD METHOD
AND WORK CAPACITY
1st – CLASS 58 SEATER
AND
TOURIST – CLASS 76 SEATER
TOURIST
WORK CAPACITY
FIRST CLASS
FIRST CLASS
DIRECT OPERATING COST
TOURIST
DIRECT OPERATING COST – 3D PENCE PER CAPACITY TON MILE
WORK CAPACITY – 10 MILLIONS OF TON MILES PER YEAR
STAGE LENGTH – STATUTE MILES


COMET 4
PAYLOAD AND STAGE LENGTH
1st – CLASS 58 SEATER
AND
TOURIST – CLASS 76 SEATER
ISA +15°C
THIS RUNWAY LENGTH IS APPROPRIATE TO A SEA LEVEL AERODROME AT 90°F
TOURIST
VOLUMETRIC CAPACITY
FIRST CLASS
THE ALLOWANCES AND RESERVES INCORPORATED IN THIS FIGURE ARE DESCRIBED IN THE TEXT
STAGE LENGTH – STATUTE MILES
AGAINST 50 MPH HEADWIND AND ALLOWING 200 MILES DIVERSION
BLOCK TIME – HR. INCLUDES 15 MIN. TERMINAL TIME

While studying the performance of the Comet 3 prototype (at left) the de Havilland Aircraft Co. is hoping to regain its lead in the jet transport field—and bolster British prestige at home and abroad—with the forthcoming Comet 4 (cutaway shown above). Estimated performance, shown in charts, gives Comet 4 stage length capacity payload of 2,945 statute miles and an estimated flight time from New York to London—with a Gander stop—of eight hours. The company claims the Comet 4, scheduled to begin flying in 1957, will be three years ahead of any U. S. jetliner.

Sikorsky Offers S-58 for $250,000

The Sikorsky Division of United Aircraft Corp. is offering the S-58, 12-passenger transport helicopter, for commercial sale with deliveries to start in mid-1956. The basic price is approximately $250,000.

The company says the S-58's 4,000 lb. payload and improved performance will make it an economic "must" for transport services now operating with smaller and less-efficient helicopters.

The helicopter can carry 12 persons or eight litters, plus a crew of two for 100 mi. It can hover, the manufacturer says, at 8,500 ft. with a payload of one ton. Normal range is 235 nautical miles.

S-58 Specifications

Performance

High speed at sea level.....115 knots
Cruising speed .....90 knots
Maximum rate of climb at sea level 1,100 fpm
Vertical rate of climb at sea level 450 fpm
Hovering ceiling with ground effect 7,000 feet
Hovering ceiling without ground effect 2,500 feet
Fuel consumption (cruising) 82 gal./hr.
Range (with normal fuel plus reserve) 235 naut. mi. (X)

Weights

Gross weight .....12,600 lb.
Useful load .....5,070 lb.
Weight empty, with standard equipment .....7,530 lb.

Specifications

Seating capacity: crew (pilot and co-pilot)
Passengers.....12 or 8 litters
Engine: Wright Cyclone C9 (same as military R-1820-84)
Ratings—take off: 1,525 bhp at 2,800 rpm at 1,900 ft. altitude
Normal: 1,275 bhp at 2,500 rpm at 3,500 ft. altitude
Dimensions:
Fuselage length .....47 ft 2 in.
Stowage length (tail pylon folded) 37 ft.
Fuselage width .....5 ft. 8 in.
Height over-all. .....14 ft. 2 in.
Main rotor diameter (blade tip circle) .....56 ft.
Tail rotor diameter (blade tip circle) .....9 ft. 4 in.
Main landing gear tread.....12 ft.
Passenger cabin length ...13 ft. 3 in.
Passenger cabin width ....5 ft. 3 in.
Passenger cabin depth .....6 ft.
Fuel capacity .....220 gal.

(X) Maximum ferry range with auxiliary fuel is in excess of 850 nautical miles (972 statute miles).

Other features of the Sikorsky S-58:

• **All-metal blades,** interchangeable and immune to temperature and humidity extremes.

• **Simplified transmission** with 25% reduction in the number of parts. Accessory drives provide for their operation during autorotation.

• **Engine or rotor head** and main transmission can be changed in three hours. Panels and doors give easy access to major components, servo units, flight controls, accessories.

• **Fuel carried in nylon** Neoprene cells under main cabin. Auxiliary fuel can provide maximum range of 970 mi.

• **Two independent hydraulic** servo systems operate on both azimuth and collective pitch control for flight safety.

Sikorsky's general manager, B. S. Whelan, estimates the S-58 can be depreciated over five years, flying 2,000 hrs. a year, to a 20% residual value. Operating cost per mile will be about $1.35 or 71 cents a ton-mile.

Sikorsky has turned over its entire Bridgeport, Conn., plant to the manufacture of the S-58, moving the S-55 operation to its new plant in Stratford. Whelan said the Civil Aeronautics Administration certification of the S-58 has been started and will be complete early next year.

Daily South American Flights Are Started

First daily one-plane through service between New York and Buenos Aires via the west coast of South America was inaugurated last week with a three-carrier interchange by Panagra, National Airlines and Pan American World Airways.

Initial schedules of the interchange service provide for two flights daily: one a first-class service the "El Inter Americano" with Douglas DC-7B equipment, and the other a tourist service "El Pacifico" with DC-6B's. First class flights will operate New York - Washington - Miami to South America while the tourist service is New York-Miami nonstop.

The new service is an outgrowth of the four-year-old New York-Balboa case decided by the Civil Aeronautics Board in July. In the same case, CAB also approved an Eastern Air Lines-Braniff Airways interchange service which the two carriers inaugurated on Aug. 18 between New York and South America with four flights weekly.

Little or no advance publicity attended the inaugural flight of National-Pan Am-Panagra due to an uncertainty of the actual starting date. Although proposed schedules were filed on 15 days advance notice as required by CAB, it was only the last minute settlemet of a pilot's dispute that permitted the three carriers to begin operations.

Final agreement calls for each company's pilots to fly their own segments of the total route. All equipment under 21 flights weekly is being provided by Panagra. Division of revenues from the interchange service will be handled between the three companies similar to connecting flights.

UAL Sees Record Fall, Winter Traffic

United Air Lines has planned fall and winter schedule patterns in anticipation of the heaviest passenger-cargo traffic for that period in the company's history.

Schedules are geared to operation of a total fleet of 176 aircraft flying a rec ord 305,918 plane-miles daily. Conversion of first-class equipment to air coach will boost seat capacity 14% above a year ago. Air coach service will account for 32% of United's total operations, a 40% rise from the same period in 1954.

Highlighting the expansion will be the inauguration of a nonstop air coach flight between Chicago and Las Vegas Sept. 23. A second, through coach flight from San Diego to Chicago and New York also will be placed into effect and direct one-plane service from the Pacific Northwest to the Southwest will be resumed under an interchange agreement with Braniff Airways.

American, Seaboard Sign Cargo Agreement

American Airlines announced last week that it has signed an interline agreement with Seaboard & Western Airlines which will permit its shippers to make trans-Atlantic shipments to or from Western Europe and the Middle East on one airway bill.

Under the agreement, westbound freight movements across the Atlantic to U.S., Canadian or Mexican terminals over American routes will be carried by Seaboard to New York where the transfer to American planes will be made. A reverse procedure will be followed for eastbound shipments.

A spokesman for Seaboard & Western said the agreement marked the first interline agreement the airline has made with an American carrier since it was granted its certificate by the Civil Aeronautics Board in June.

British Exports

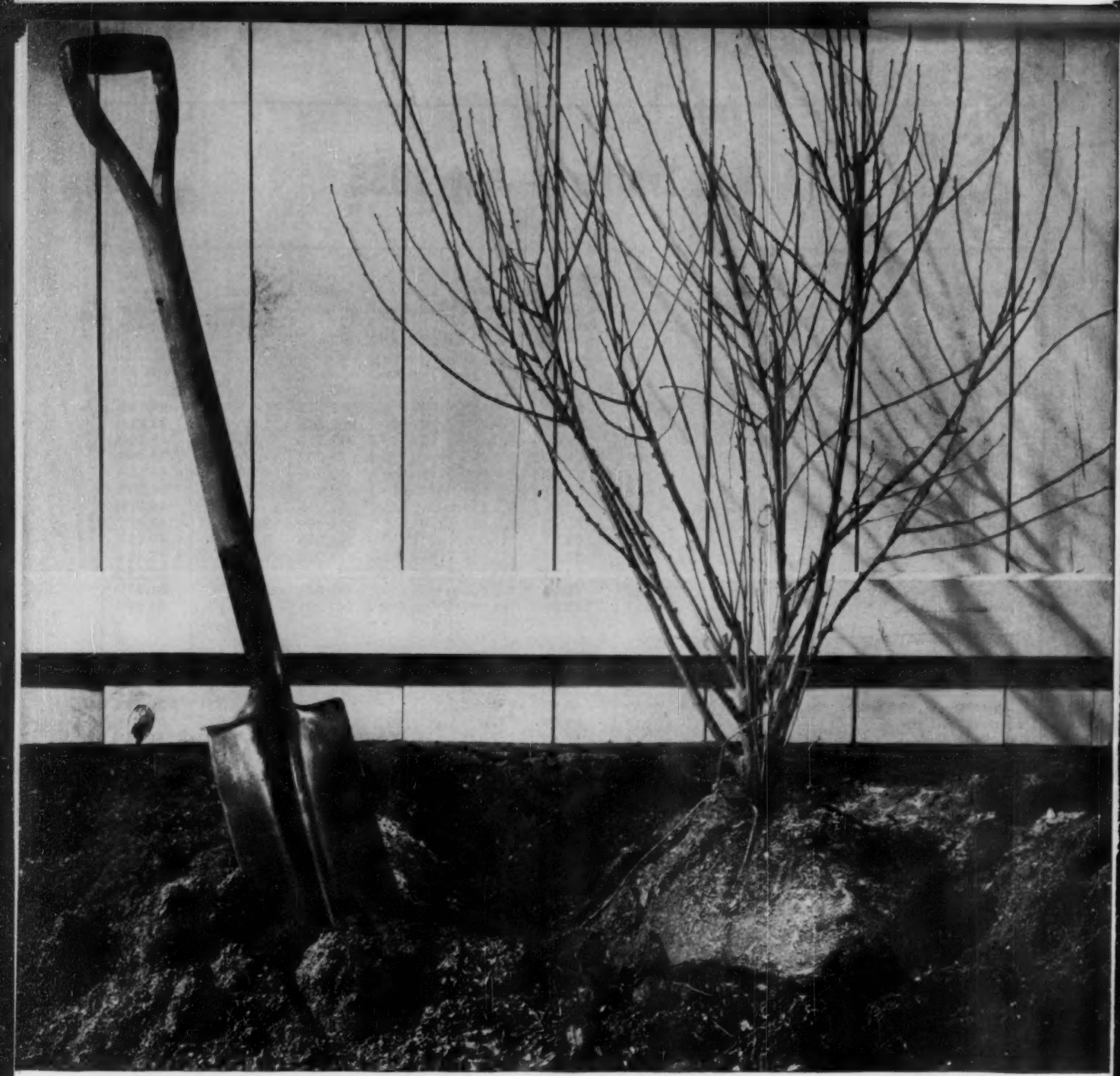
British aviation exports for the first six months of 1955 totaled approximately $63.3 million. Last year's total was about $157.6 million.

Airline Traffic — July 1955

	Revenue Passengers	Revenue Passenger Miles (000)	Revenue Passenger Load Factor	U. S. Mail Ton-Miles	Express Ton-Miles	Freight Ton-Miles	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American Airlines	637,705	396,934	69.20	1,318,462	779,062	5,043,733	44,873,728	59.14%
Braniff Airways	137,241	52,193	59.44	149,210	101,829	265,848	5,509,014	52.85%
Capital Airlines	237,008	73,854	59.45	240,683	207,173	313,019	7,817,255	43.70%
Colonial Airlines	42,828	10,642	51.92	12,496	5,380	23,569	1,031,509	50.46%
Continental Air Lines	*	20,362	53.84	59,898	26,763	99,562	2,135,057	45.58%
Delta—C & S Air Lines	170,221	77,515	63.87	235,530	190,601	517,576	8,373,318	58.20%
Eastern Air Lines	536,839	266,708	63.75	733,355	390,655	1,052,219	29,126,838	48.87%
National Airlines	98,026	68,645	71.36	210,477	43,621	271,828	7,495,880	69.21%
Northeast Airlines	80,670	16,040	62.57	11,067	16,633	48,996	1,527,934	59.15%
Northwest Airlines	121,751	85,659	67.16	376,586	194,402	513,214	9,478,771	58.42%
Trans World Airlines	345,104	283,417	69.53	973,796	583,135	1,804,688	20,470,577	62.56%
United Air Lines	514,655	361,581	72.18	1,798,201	898,974	3,319,273	40,755,927	61.37%
Western Air Lines	101,191	49,717	62.89	185,041	65,812	191,081	5,190,100	56.38%
INTERNATIONAL								
Braniff Airways	3,443	7,480	50.89	31,248	.....	67,280	848,312	45.32%
Caribbean Atlantic Airlines	14,128	1,089	60.97	896	.....	2,871	103,555	57.64%
Colonial Airlines	4,220	3,266	73.36	1,706	.....	3,467	354,132	77.89%
Delta—C & S Air Lines	4,385	4,867	48.63	7,161	.....	38,003	345,634	39.14%
Eastern Air Lines	20,144	29,011	83.09	47,239	.....	59,179	3,181,730	73.31%
National Airlines	10,483	4,958	56.42	7,775	2,694	33,354	546,345	50.23%
Northwest Airlines	10,273	21,691	62.87	813,776	15,676	628,993	3,742,328	68.67%
Pan American World Airways								
Alaska	9,710	13,831	73.24	37,020	.....	373,595	1,762,103	56.51%
Atlantic	98,180	132,874	74.38	788,321	.....	1,516,751	15,862,122	70.76%
Latin America	105,255	102,634	73.38	301,239	.....	2,459,216	12,391,872	66.34%
Pacific	21,260	64,130	72.22	1,031,865	.....	953,708	8,653,602	69.15%
Pan American-Grace Airways	11,782	14,754	61.40	42,791	.....	297,184	1,906,194	58.57%
Trans World Airlines	29,918	79,574	79.36	812,092	.....	666,215	9,634,635	73.76%
LOCAL SERVICE								
Allegheny Airlines	38,384	6,272	48.64	6,357	15,391	.....	619,955	48.73%
Bonanza Air Lines	10,101	2,163	42.74	2,912	1,900	4,302	215,476	40.91%
Central Airlines	8,845	1,313	29.74	3,380	1,357	4,603	134,633	26.68%
Frontier Airlines	18,086	4,492	49.44	13,961	7,694	65,089	515,383	59.63%
Lake Central Airlines	11,164	1,636	33.47	2,351	8,675	.....	159,006	38.21%
Mohawk Airlines	24,934	4,455	50.88	4,200	5,678	7,880	441,940	50.47%
North Central Airlines	46,408	7,410	55.61	15,352	24,569	.....	749,547	48.93%
Ozark Air Lines	21,813	3,212	36.52	5,927	12,001	.....	317,923	36.66%
Piedmont Aviation	35,633	7,012	58.21	11,733	8,596	12,624	703,335	57.30%
Southern Airways	14,575	2,471	41.01	7,926	9,298	.....	253,374	38.81%
Southwest Airways	25,552	5,033	59.68	5,532	4,914	8,608	498,440	58.05%
Trans-Texas Airways	13,784	3,156	40.01	11,585	5,511	12,650	330,131	36.62%
West Coast Airlines	19,922	3,456	47.17	4,022	2,207	5,376	323,522	47.03%
HAWAIIAN CARRIERS								
Hawaiian Airlines	43,883	5,942	66.10	3,058	.....	137,460	667,448	55.97%
Trans-Pacific Airlines	22,937	2,913	59.70	780	56	9,617	232,393	56.91%
CARGO LINES								
Aerovias Sud Americana	.....	.....	.....	.....	.....	440,829	440,829	40.43%
Flying Tiger Line	2,075	3,397	86.72	.....	.....	3,090,883	3,430,564	66.00%
Slick Airways	1,434	5,370	85.47	38,921	.....	3,789,092	4,364,983	75.67%
HELICOPTER SERVICE								
N. Y. Airways	2,600	51	63.75	1,157	1,177	389	7,492	54.94%
Los Angeles Airways	515	13	.....	4,184	1,538	.....	7,230	41.81%
Helicopter Air Service (Chicago)	.....	.....	.....	2,297	.....	.....	2,297	40.17%

* Not Available.

Compiled by **AVIATION WEEK** *from airline reports to Civil Aeronautics Board.*



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Air Travel Will Double by 1965, Cargo to Triple, CAA Forecasts

A two-fold increase in air travel within 10 years is predicted by the Civil Aeronautics Administration.

Big gains are forecast by CAA in all branches of the industry, assuming a continued expansion of the national economy and the population. An increasing proportion of consumer income will be going to air travel with "air transport's share of the common carrier market rising from the current 29% to more than 50% by 1965," the agency reported.

The predictions were made in a recent study, "Civil Air Traffic Forecasts, 1960-65."

CAA expects the domestic airlines to carry 70 million revenue passengers by 1965, more than double the 1954 figure of 32.3 million. A large part of the increase is predicted on expanded coach service to medium and short-haul operations, and from inauguration of intercity helicopter service. "If helicopters effectively develop the true short-haul market," CAA said, "the forecast may be too low."

Air Cargo Outlook

The international and overseas passenger total for U.S. airlines will rise from a 1954 level of 2.8 million to 6 million, CAA estimated, with North Atlantic, Pacific and Alaskan traffic increasing at a faster rate than Latin American business.

A more promising outlook is seen for air cargo. CAA forecasts an annual increase in volume of slightly more than 10%, to a figure of 800 million ton-miles in 1965, or three times the 1954 level.

Major reason for the anticipated expansion is the prospect of more economical cargo aircraft and improved ground handling methods.

In the field of general aviation, which includes all civil flying other than air carrier operations, CAA expects the 14 million hour mark to be reached by 1965. This compares with 8.8 million hours in 1954.

Deliveries in 1965

Business flying, by companies and individuals, will continue to show the most rapid growth of any segment of general aviation, CAA believes, until by 1965 it accounts for 51% of the total.

A gradual increase in pleasure flying is also forecast to a 1965 level of 2.6 million hours.

To carry anticipated traffic, aircraft manufacturers will deliver 400 large civil transports in 1965, valued at $600 million, according to CAA. Production of smaller types for utility and executive use (weighing under 3,000 lb.) will reach 600 in 1965 and be valued at $240 million.

'Slumber-Ease' Seats

Northwest Orient Airlines is almost doubling the space allotted to each first-class passenger on its fleet of Turbo-Compound Super Constellations used on the airline's Orient runs. The carrier is introducing "slumber-ease" seats while cutting the number of first-class accommodations from 19 to 11.

Each passenger will have about five feet of space longitudinally. Seats are fully reclinable and have leg rest attachments.

New Job for Solent Flying Boat

One of the two Short Solent double-decker flying boats recently bought by South Pacific Air Lines is shown undergoing overhaul at Trans-Ocean Air Lines' base, Oakland, Calif. The Hawaii-based operator will use the Solents from Honolulu down through Polynesia. The Solent has a range of about 2,000 mi., powered by four Bristol Hercules engines.

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(this advertisement appears every week)

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Aero Supply Mfg. Co. Inc. of Corry, Pa., announces a series of general engineering data bulletins of a non-advertising nature prepared by Aero Supply's Research and Development Center recently established in Cleveland, Ohio. The bulletins consist mainly of technical data with charts, graphs and other valuable information related to the design of aircraft, rocket and missile fuel systems.

The first four bulletins show viscosity vs. temperature data for approximately 120 different fluids and has been prepared for availability on or about September 6, 1955. Subsequent bulletins will appear at approximately one month intervals.

For over 39 years Aero Supply Mfg. Co. Inc. has been a leading designer and manufacturer of fuel system components, cockpit controls and related articles for all flight applications. Qualified representatives and engineers are readily available upon request to offer assistance on specific engineering and application problems.

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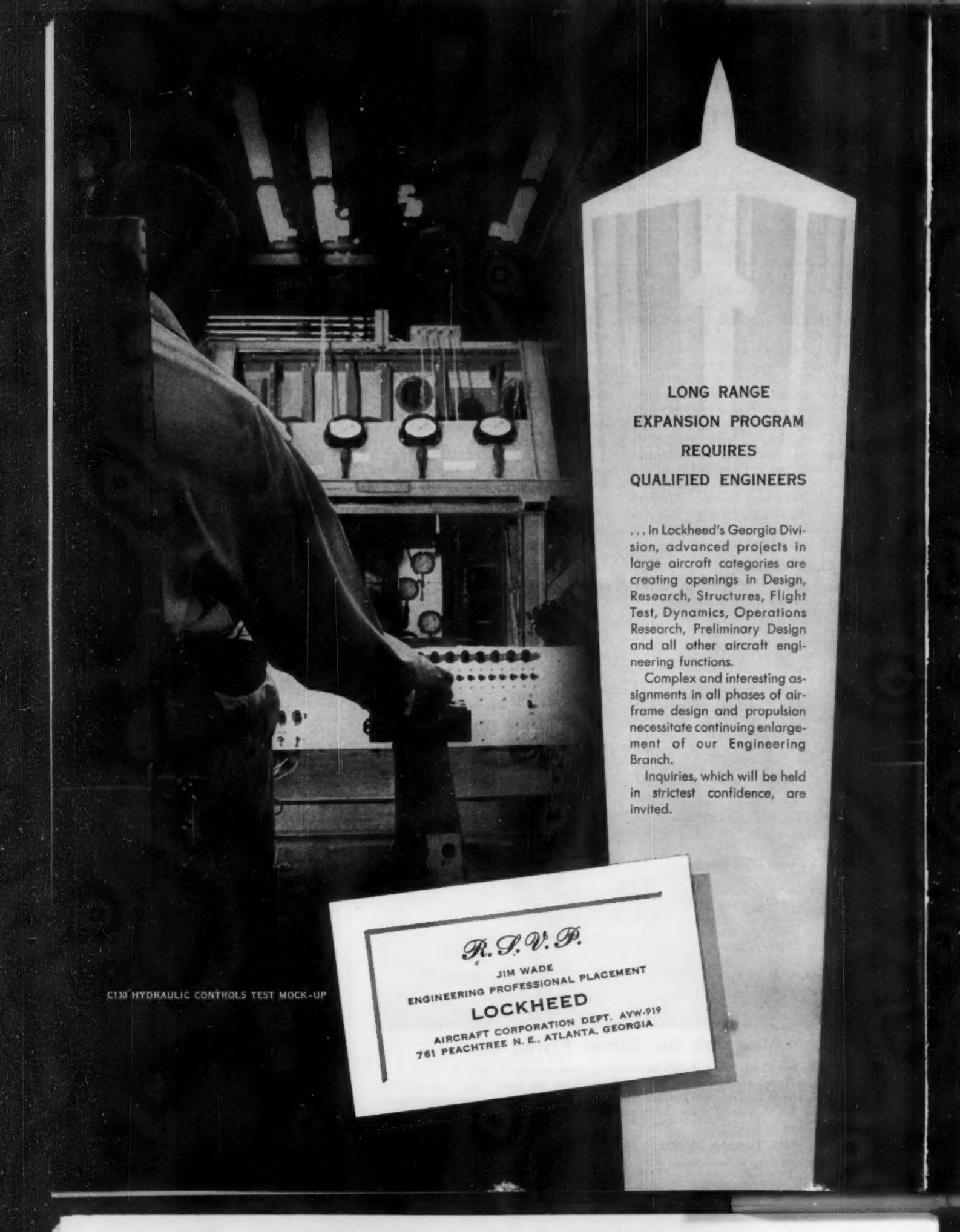

C130 HYDRAULIC CONTROLS TEST MOCK-UP

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CAB ORDERS

(Aug. 30-Sept. 7)

GRANTED:

Seaboard & Western Airlines approval of trans-Atlantic all-cargo service plan.

Florida civic groups permission to intervene in the certificate renewal case of Mackey Airlines.

Iowa civic groups permission to intervene in the investigation for service by Ozark Air Lines between Peoria, Ill., and Fort Dodge, Iowa, via Galesburg, Ill., Burlington, Ottumwa and Des Moines, Iowa.

ORDERED:

Frontier Airlines to show cause why the Board should not issue a permanent certificate for local service allowing 27 points permanent certification and 12 points temporary.

APPROVED:

Agreements between Western Air Lines, American Airlines and various other carriers relating to inter-carrier arrangements.

Los Angeles Airways amended flight pattern for an additional round-trip daily mail shuttle between Los Angeles and Glendale and add Anaheim as a flag-stop on four trips daily.

Increased fares, first class and tourist, between Hongkong and Saigon and the elimination of excursion fares between these points as adopted by the International Air Transport Assn.

Agreements between American Airlines, Iberia Airlines of Spain and various other carriers relating to inter-carrier arrangements.

DISMISSED:

Complaints from the Chambers of Commerce of Seattle, Tacoma and Spokane against the round-trip coach excursion fares filed by American Airlines, Trans World Airlines and United Air Lines.

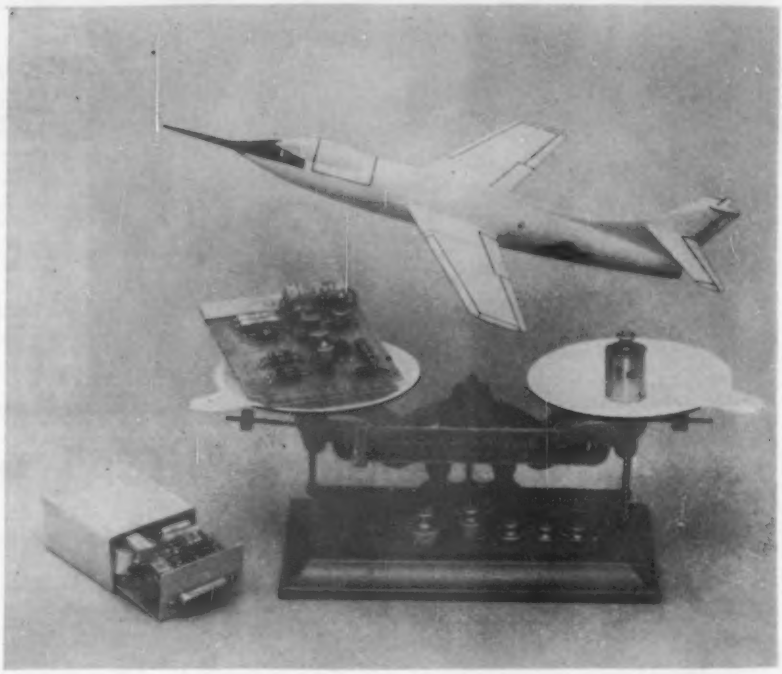
Applications of Continental Air Lines and Pioneer Air Lines for route adjustments at the request of applicants.

Application of W. F. Long and Continental Airlines for approval of interlocking relationship upon motion for withdrawal.

SHORTLINES

▶ **United Air Lines** passenger traffic during August reached 410,565,000 passenger miles, the highest level in company history and an increase of 8% over August 1954. The airline also operated 10,182,000 airplane miles, up 7%; 1,125,000 express ton miles, up 3%; and 2,038,000 mail (including first class) ton miles, down 7%.

▶ **British Overseas Airways Corp.** reports that film consignments amounted to 42% of all special-rated cargo flown from New York to England.



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At TI, extensive military design and production experience is enhanced by leadership in transistor manufacture. Silicon transistors, mass-produced only by Texas Instruments, far exceed MIL-T-5422C temperature specifications and more than meet all military environmental specifications. The world's leading transistor manufacturer, TI also produces subminiature transformers, deposited carbon resistors and other precision components for high efficiency operation in miniaturized circuits.

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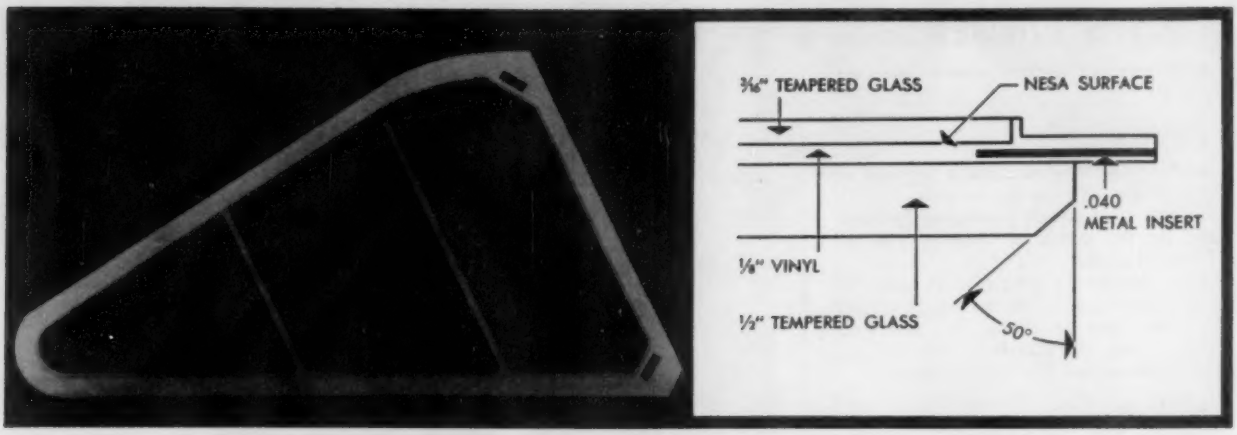
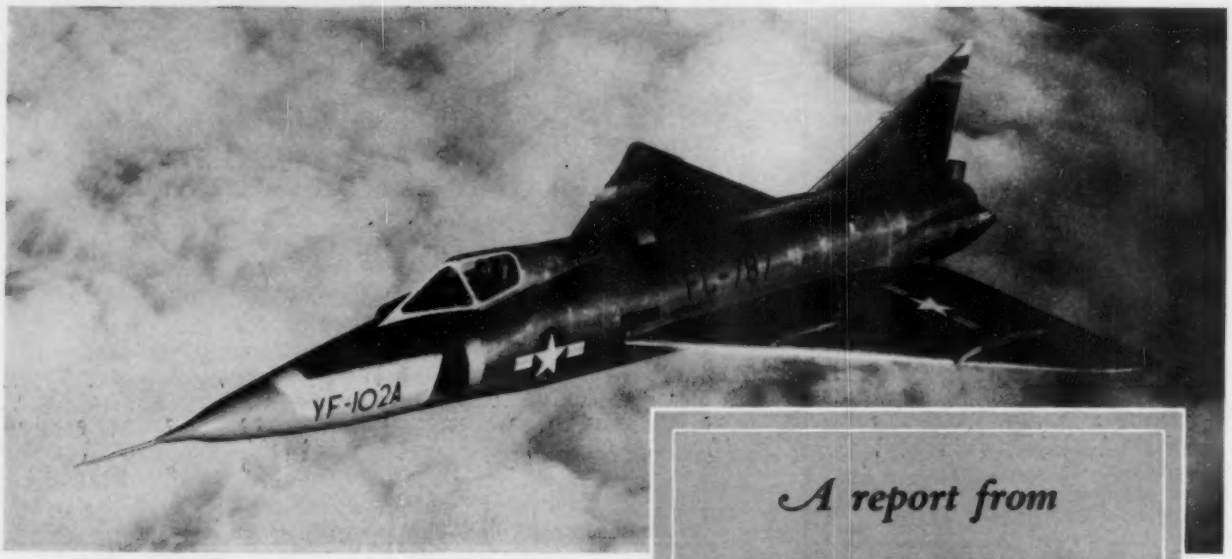


How anti-icing "NESA"® windshields are used in the Convair F-102A



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PPG electrically-heated NESA windshields with metal insert Flexseal® edges, give the F-102A improved visibility and safety. The windshield consists of 3/16" and 1/2" thick plies of tempered polished plate glass with a 1/8" vinyl filler. Electrical current, carried by the NESA coating of the inboard surface of the outboard glass, prevents ice formation and gives freedom from frost and fogging.

Pittsburgh Plate Glass Company makes all types of glass for aircraft applications. A Pittsburgh technical representative will work with you on any aircraft glazing problem, to help you develop the proper glass combination to meet the specific requirements of your aircraft design.

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From the Editor's Notebook

With the successful 1955 National Air Show at Philadelphia, this institution has completed its metamorphosis from the pylon bending, crash-marred spectacles at Cleveland to a spectacular, significant and safe annual report to the American people on the state of their military airpower. The record attendance of 290,000 people despite one day of bad flying weather is ample proof that the American people are intensely interested in the military airpower that is now their first line of defense and their formula for survival in the age of the hydrogen bomb. Surprising to veteran observers of the show was the tremendous drawing power of the static displays of aircraft and aviation products. Even while the flying program was in full swing, thousands of people patiently plodded through the parked aircraft and wandered around the military and industry displays. Both the military and industry ground displays were the best since the show began to shift to its new format.

Military Flying

All of the services tailored their flying displays to emphasize their special military mission. The Navy had the aircraft carrier Ticonderoga anchored in the Delaware River where it could catapult-launch planes and land helicopters in full view of the audience. The Army and Marine helicopter assault demonstrations gave the audience a spectacular briefing on the new role of ground troops. USAF paraded its combat ready aircraft as well as new prototypes such as the McDonnell F-101, Convair F-102 and the Lockheed C-130 Hercules in an impressive show of both types and numbers.

General Edwin Rawlings, who was Defense Department co-ordinator for the show, and his staff deserve credit for operating a lively, safe and significant flying display. Philadelphia was pleasantly surprised by the show, shifting from a luke-warm pre-show attitude to an enthusiastic bid for a return engagement after the show was over. Defense Department policy, however, aims at annual rotation of the show to different sections of the country in order to spread the airpower doctrine among the taxpayers. The Midwest is the likeliest spot for the 1956 show with the Dallas-Ft. Worth area, Chicago or the Twin Cities, Minneapolis-St. Paul among the bidders.

World Records

Now that Col. Horace A. Hanes in the North American F-100C has set the first supersonic world speed record of 822 mph. over a new type of altitude course, it is unlikely that any foreign planes will lift the trophy from the United States in the foreseeable future.

If the English Electric P. 1 or the Fairey Delta make an attempt, the Lockheed F-104, the McDonnell F-101, the Convair F-102 and the Vought Crusader are all capable of outperforming the British entries.

However, it is about time that American aircraft manufacturers did something about the world altitude record that has been reposing in Britain for some years. American aircraft may have trouble topping the 65,876 ft. record set in August by the Bristol Olympus-powered Canberra test bed. But the Chance Vought F8U-1 Crusader, prototype Navy carrier-based fighter, has been performing well above 60,000 ft. and may be the plane to top the British record. Douglas F4D tried hard but failed to reach 60,000 ft. on its official attempt. Pratt & Whitney J57 is apparently over its high altitude ducting and operational problems judging from the F8U performance.

NACA Area Rule

In last week's editorial on the security history of the NACA area rule there was a reference to Aero Digest magazine that apparently was not understood by all our readers. We did not intend to infer that a portion of the area rule story had been previously published in Aero Digest. The fact is that in September, 1954, the editor of Aero Digest, who is no longer with the publication, wrote a fragmentary account of the area rule application to the Grumman Tiger in another magazine with limited circulation in the aviation industry.

Quarles Policy

Appearing in a panel of newsmen questioning USAF Secretary Donald L. Quarles on the Columbia Broadcasting System network television show "Face the Nation" we asked him about future research, development and production policies on military aircraft. Secretary Quarles answers indicated that he firmly believes USAF must have a strong and sustained research and development program to outpace the Russians and that this is no time to reduce or impair the strength of our airpower in being. Acceleration of B-52, F-101 and F-104 production will definitely proceed as planned, Secretary Quarles said.

Queried on whether: "There is anything in your intelligence reports that indicates that this is the time to slow down an accelerated aircraft program?" Quarles replied:

"My information would lead me to feel strongly that we should not slow down our program to build up a most modern and effective air force."

—Robert Hotz

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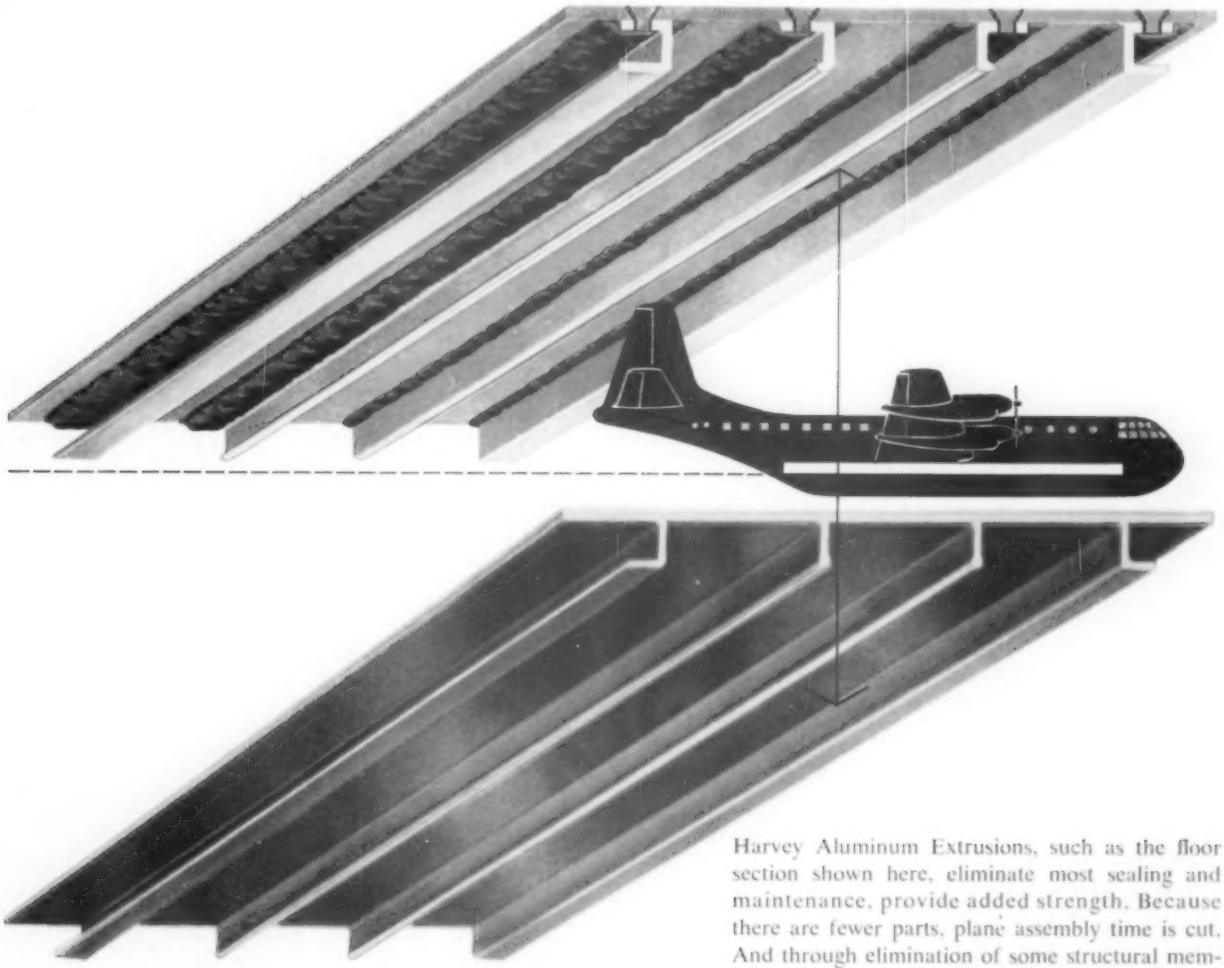
With high-altitude flights now standard, aircraft cabins – both military and civilian – must be pressure-tight. Conventional construction once made it necessary to seal every joint and rivet hole, a time-consuming manual process that added hundreds of pounds of dead weight to every plane. *And normal operation always caused eventual leaks.*



Harvey Aluminum Extrusions, such as the floor section shown here, eliminate most sealing and maintenance, provide added strength. Because there are fewer parts, plane assembly time is cut. And through elimination of some structural members, the floor depth is decreased. *The result . . . less dead weight, more cabin space.*

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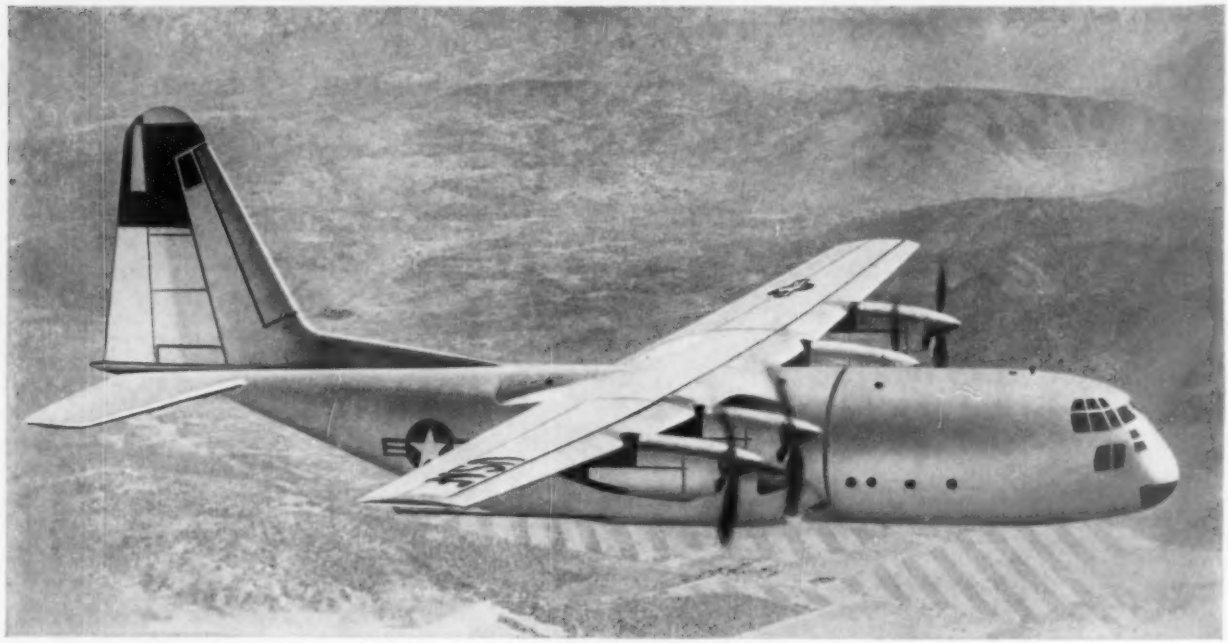

Production rolling on New Allison Turbo-Prop-powered Lockheed C-130 Hercules

AMERICA'S first production Turbo-Prop transport – the Lockheed C-130 Hercules – is coming off the lines of Government Aircraft Plant No. 6 in Marietta, Georgia, in growing numbers.

Powered by four Allison T56 Turbo-Prop engines with a total of 15,000 horsepower, this new cargo plane can carry some 20-ton payload long distances *at amazingly low operating cost.*

With its exceptional power-to-weight ratio, the Hercules can take to the air at a 30 degree angle after a ground run of less than a thousand feet, considerably less than other planes of comparable size. Its low fuselage floor, 41 inches off the ground, provides truck-bed loading, while the adjustable tail ramp also permits vehicles to drive directly aboard.

Developed for the Tactical Air Command, the Hercules is a highly mobile, high-speed transport, able to rush men and materiels to advanced areas and evacuate wounded.

The Allison Turbo-Prop engine which powers it is the first Turbo-Prop to receive CAA certification for commercial use–a promise of early application in peacetime commercial passenger and cargo service.

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